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MDCCCXXXV.

ADVERTISEMENT.

The interest of the following pages will, it is hoped, be found to accord with that of the scientific research of the past year, and to blend entertainment with information of the most valuable character.

In the *Mechanical* department of this Miscellany will be found Notices of the stupendous Steam-vessels, which have excited so much interest; a representation of Mr. Hancock's last new Steam-carriage; a popular paper upon the mode of Illuminating Lighthouses; the details of the erection of the York Column; Sir John Herschel's important improvements in Reflecting Telescopes; the Birmingham New Town-Hall, and its Organ; a comprehensive view of the Railways in America; an illustration of the expediency of Babbage's Calculating Machinery; two valuable papers on Mines; and improvements in Steam Navigation, Steam-carriages, and the construction of Railways, with a description of the splendid line between Dublin and Kingstown. In this division are also included brief Reports of the British Association, and the Society of Arts; details of their Novelties occupying portions of the subsequent pages.

In *Chemical Science* are, Professor Ritchie's mode of Detonating Oxygen and Hydrogen by the Magnet; the economy of Carrageen, or Irish Moss; the Rotary Motion of Camphor investigated; the construction of a new Vapour Lamp; Tests for Hydrocyanic Acid; a new Indelible Ink, by Berzelius; the details of Dr. Ure's Thermostadt, or Heat Governor; Dr. Bostock's examination of the Water of the Metropolis; two papers by Dr. Turner, on Filters in Chemical Analysis, and the Decomposition of Glass; Professor Hare's Apparatus for making Ice; discovery of the Antiputrescent principle of Pyroligneous Acid; popular illustrations of the Prevention of Dry Rot; new Analyses of Corrosive Sublimate and Calomel; the products of Coal Gas; an abstract of Mr. Faraday's Experimental Researches in Electricity; with several novel illustrations of Electricity and Magnetic Intensity; and an abstract of the New Facts reported to the British Association.

In the *Naturo-historical* departments are many sterling papers. In *Zoology* are, an investigation of Professor Ehrenberg's Observations on the Brain; a paper on the Functions of the Brain, by Sir Charles Bell; the Nervous System of the Cod-fish, and discovery of a Muscle in the Eyes of Fishes; the economy of some Cetacea, by Professor Traill, and an Anatomical examination of a specimen, by Dr. Knox; an illustrated contribution,

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Fig. 1. A. Vessel for Curd; B. Vessel for Whey; C. Tube from A to B; D. Air-pump for exhausting the air in B; E. Tube communicating from D to B; F. Cock for letting off the whey from B.

Fig. 2. False bottom for the vessel A; G. Wood frame; H. Wire cloth.

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&c. &c.

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(*See the Frontispiece.*)

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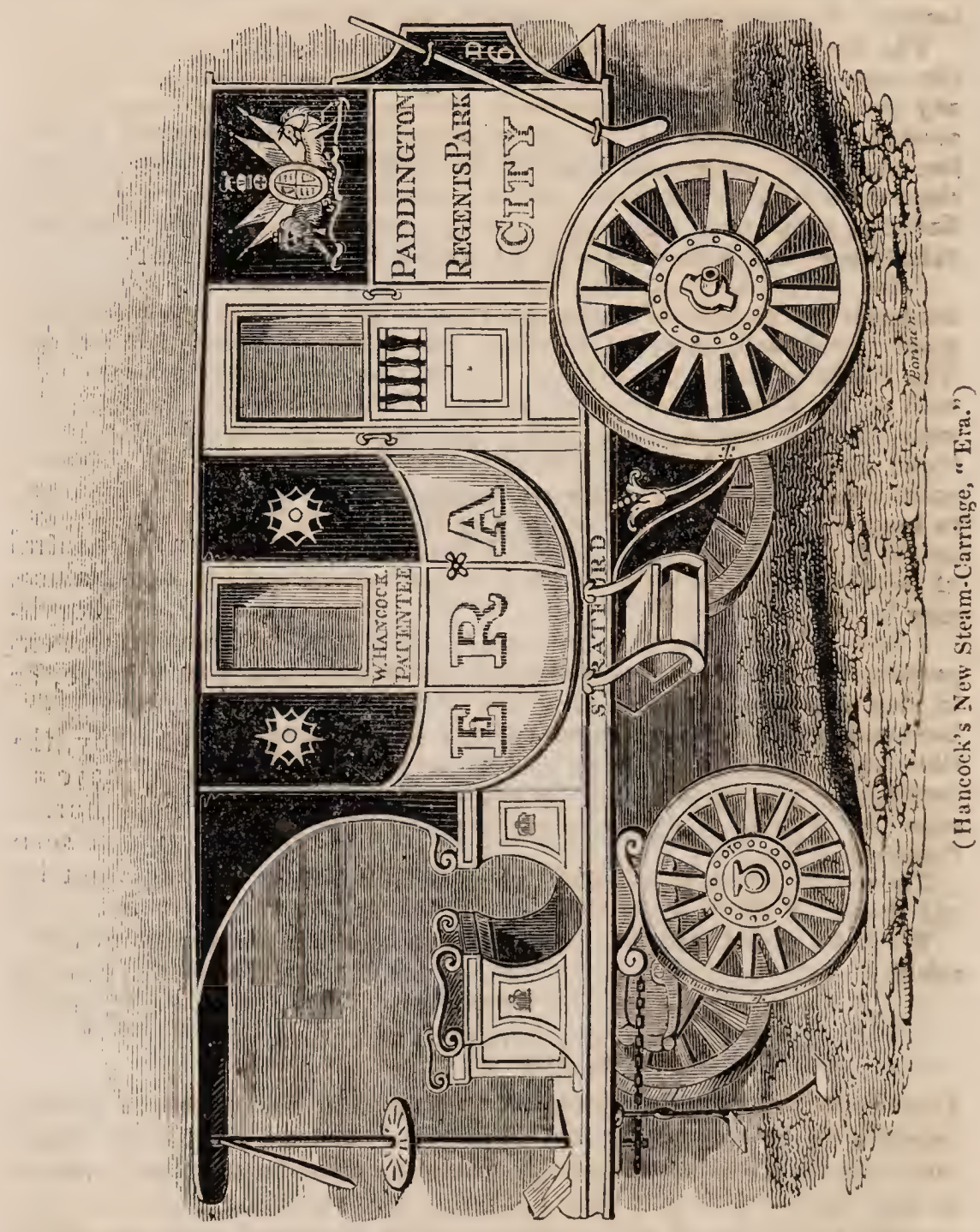
These gates have been hung, experimentally, on Mr. Collinge's patent hinges: the steel sphere of the hinge was, however, not applied, but a mahogany one was used in its place; and a child might open and shut the gates when thus hung.

The total cost of these gates is three thousand guineas. The side openings of the Buckingham arch are not, we believe, to be filled similarly to the centre: they will merely have halbert gates.

HANCOCK'S NEW STEAM-CARRIAGE, "ERA."

WITHIN the year, Mr. Hancock has completed the beautiful and commodious carriage represented in the engraving. We subjoin the substance of a statement of the performances of the Autopsy and this carriage, on the road between London and Paddington, from August 18 to October 11, 1834; furnished by Mr. Hancock to the *Mechanics' Magazine*, No. 585.



(Hancock's New Steam-Carriage, "Era.")

The Autopsy commenced running on the 18th of August, and continued about a month going each day twice to and from Moorgate to Paddington, and twice to and from Moorgate to Islington. Nothing particular

occurred to the machinery, save the shaking out of the key of the slide valve, when it was found necessary to draw the Autopsy home by the Era. The eyes of the carriage springs gave way a little, but were replaced by stronger ones. The principal wear has been in the wheels; and this chiefly owing to the smallness of their diameter, when encountering the deep holes in the wretched pavement of Finsbury-square. The tires of the wheels were also found to elongate rapidly, which made it requisite to have them contracted. New wheels have just been put on this carriage, of larger diameter and thicker tires. The boiler has been carefully examined, but not the least perceptible difference has been detected. The fire-place, too, remains nearly the same.

The Era has now been running rather more than a month, performing the same distances as the Autopsy, but in a manner superior to that or any carriage I have either previously built or known. The crank shaft severed at a bad part of the bad pavement in Finsbury-square a day or two after she commenced running; but this was replaced, and the carriage started the next morning at the usual hour, and has ever since continued at work, with the omission of only one journey, arising from the extension of an unsound place in the casting of the wheel flange.

I find on this hard road the wheels are severely tried; but this road, hard as it is, has been of inestimable value to me in regard to experience, pointing out, with unerring certainty, where more strength is wanting. The Stratford road, for instance, would have completely deceived me, with regard to wear and tear of wheels. I should estimate the tear and wear on the former at double that of the latter; but then it should be borne in mind, the Macademized part, from King's Cross to Tottenham-court-road, is in a very rough state. I would advise all parties interested to keep this fact in view; they must bring their vehicles to a similar test before they can conclude experiments having for their object the means of arriving at a just estimate. On level and smooth roads a great display may be made, but such trials are fallacious and deceptive.

I forgot to mention, that sometimes, when I have had to take up a passenger on a bad piece of pavement, if the propelling wheels chanced to stop in a hole, the friction on the (perhaps only two) stones has not been sufficient to start the carriage; but by reversing the motion of the slide valves, and backing a few feet (just as you would with horses), the carriage is at once propelled forwards. But we may surely hope, that some day or other, the great public thoroughfares will not be suffered to remain in holes.

The consumption of coke has hitherto been from 8 to 12 lbs. a mile, and about 100 lbs. of water for the same distance.

We have, up to this time, carried nearly 4,000 passengers in perfect safety.

INVENTION OF THE MARINER'S COMPASS.

THE invention of this precious instrument has hitherto been awarded to Flavio Gioia, a Neapolitan, in 1302, or 1303. But this statement has rested on no satisfactory evidence; and, when it was discovered that the Chinese and Arabian authors had spoken of the magnet's polarity before the fourteenth century, it began to be suspected that the Neapolitan was merely the introducer of the compass into Europe. To settle the question,

in January, 1834, Baron Humboldt wrote to M. Klaproth to ascertain the epochs,—1st. When the Chinese discovered the polarity of the magnet; and, 2nd. When they began to apply it to the purposes of navigation. M. Klaproth has replied in a work, published in Paris towards the close of the year, in which the most remarkable proof of the Chinese claims to this invention, is in the history of the magnetic chariots, whose origin is lost in the obscurity of the mythological ages. The accompanying representation of one of these chariots is taken from the 33rd volume of the *Japanese Encyclopædia*.

The figure in front of the chariot was made of some light material; it was fixed upon a pivot, and its finger invariably pointed to the south, which, as we have already said, was the *kibleh*, or sacred point of the Chinese, to which they always turned when performing their devotions. It is intimated rather obscurely, that these magnetic chariots were first invented for a religious purpose, namely, to enable the devout to discover their *kibleh* when the sun and stars were obscured by clouds—a purpose to which the compass is frequently applied in the present day by Mohammedan nations; but there are very full descriptions of the use made of these chariots in directing the march of armies, and guiding ambassadors. M. Klaproth has collected, from Chinese authorities, many curious anecdotes of the use made of these chariots; under the Tsin dynasty they formed a part of every royal procession. In the *Tsin-tchi*, or history of that dynasty, we find—"The wooden figure placed on the magnetic car resembled a genius wearing a dress made of feathers; whatever was the position of the car, the hand of the genius always pointed to the south. When the emperor went in state, one of these cars headed the procession, and served to indicate the cardinal points."

(Magnetic Chariot.)

In the history of the second Tchao dynasty, which lasted from

A.D. 319 to A.D. 351, we read,—"The Chang-Fang (president of the board of works) ordered Kiai Fei, who was distinguished by his great skill in constructing every kind of instrument, to build a number of magnetic chariots, which were sent as presents to the principal grandees of the empire." There are several accounts of the manner in which the magnetic figures were constructed: as our readers have probably anticipated, a magnetized bar passed through the arm of the figure; and the only variety of ingenuity displayed by the architects was in balancing the figure upon its pivot.

The antiquity of these magnetic chariots is established incontrovertibly; the step from them to the compass is so very easy, that we may safely assert that the one must have led immediately to the other.*

PORTABLE FIRE-ENGINE.

A MECHANIC at Augsburg, of the name of Eckhardt, has invented a portable fire-engine, which throws up 52 quarts of water to the height of 48 feet each minute. Though one man can work it, its effect is much increased by the labour of two. The diameter at the mouth does not exceed half an inch; the barrel itself is 18 inches in length and diameter, contains a bucket of water, and as the weight of the whole apparatus is not more than 53 pounds, it may be moved about with perfect ease.†

SOCIETY OF ARTS.

THE Anniversary was held on June 3; the Duke of Sutherland, one of the vice-presidents, took the chair. The meeting was held in the great room of Exeter Hall, which was crowded to excess. In the classes of agriculture, chemistry, colonies and trade, manufactures, mechanics, the polite arts (amateurs and artists), fifty-nine prizes were awarded. As we have not space to enumerate all the subjects, we subjoin the following selection of what appeared to us to be the most important:—

To Mr. C. Bush, 7, Garden-row, Camberwell, for his improved caster for tables, &c., the silver Isis medal. For his folding-shutters for a shop, the large silver medal.—To Mr. J. Hughes, 93, Sebright-street, Bethnal-green-road, for his warping-jack for silk-weavers, five pounds.—To Capt. T. M. Bagnold, R.M., 7, High-row, Knightsbridge, for his anotomical puncturing forceps for preventing accidents in sewing up bodies after *post mortem* examinations, the large silver medal For conveying seeds of Araucaria imbricata in a vegetating state from Chili to London,

* From a clever notice of M. Klaproth's work, in the Athenæum, No. 369.

† Printing Machine, No. 17.

the large silver medal.—To Capt. J. N. Colquhoun, R.A., for his communication on dried plantains, the large silver medal.—To Mr. Roger Brown, Sheffield, for his improvement in the electrical machine, the silver Isis medal. To Mr. Geo. Edwards, Lowestoff Harbour Works, for an improved wind-gage, the large silver medal.—To Thos. Tassell Grant, Esq., Weovil, for his machinery for making ships' biscuit, the large gold medal.—To Mr. J. Gray, 4, Upper East Smithfield, for his illuminator for a marine sextant, the large silver medal.—To Richard Greene, M.D., Cork, for his machine for grinding and polishing large specula and lenses, the large gold medal.—To Commander J. Pole, R.N., for his improved carriage for long pivot guns on board ship, the large silver medal.—To Capt. Lihou, R.N., for his improvements in ships' rudders, the large silver medal.—To Mr. W. Hookey, 6, Prospect-place, Lower-road, Deptford, for his method of strengthening the top-sides and decks of ships, the large gold medal.

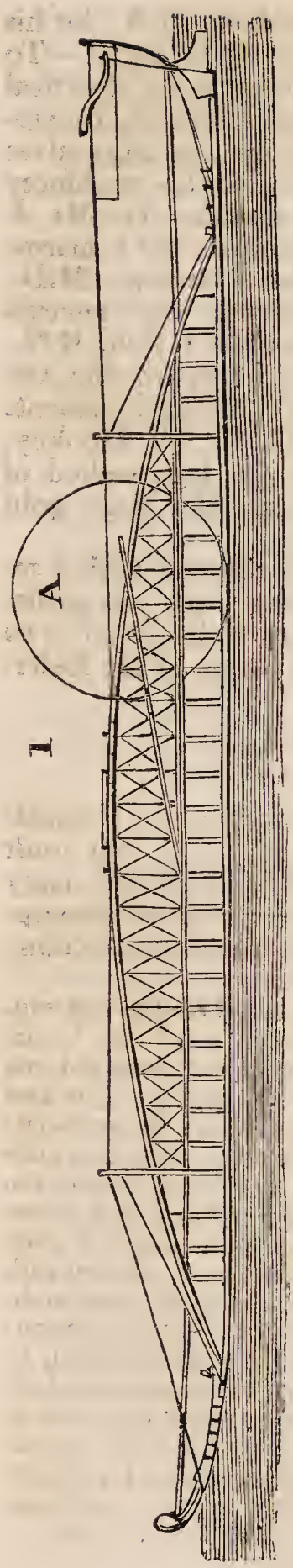
Mr. Aikin, the secretary, in an admirable address, took a review of the Society's proceedings, and alluded, with just pride, to the illustrious names in science and the arts to be found in its archives—names which were first brought to notice by the fostering care of the Society.*

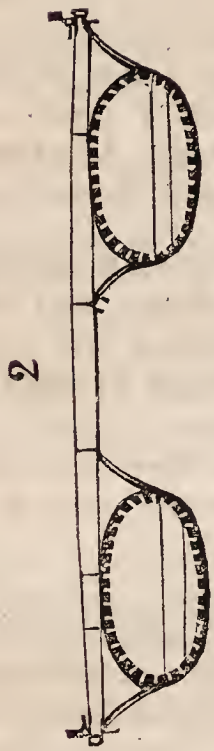
CANADIAN TWIN STEAM-BOAT.

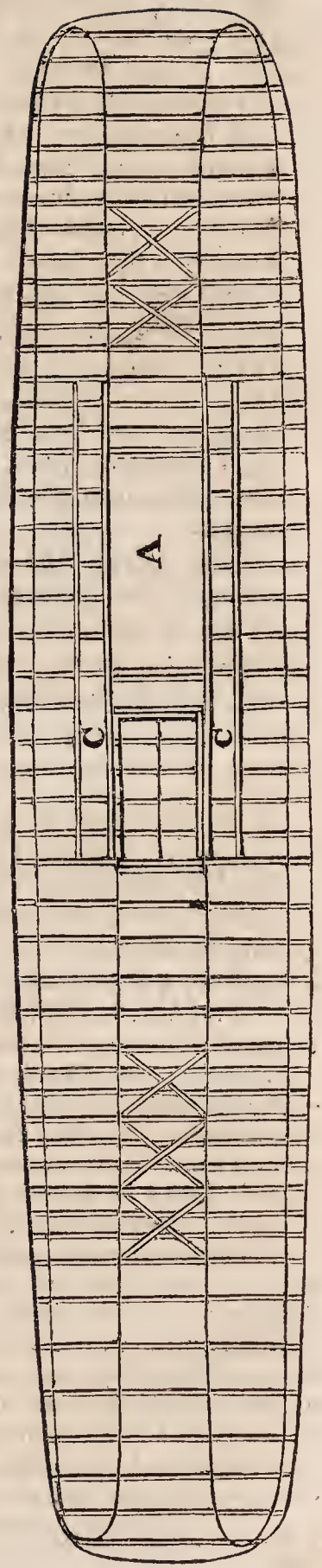
A VAST steam-boat has been built by Mr. Sandford, in Prescott Harbour, Upper Canada, upon a principle similar to that built by Mr. Burden, (represented at page 23), but exhibiting many important improvements. The engravings to which the description refers are, 1, a longitudinal section; 2, a transverse section; and 3, a plan:—

The boat is 179 feet in length, by 36 feet 6 inches in breadth, and supported by two elliptical cylinders, 177 feet in length, and 9 feet in diameter, flatter in the bottom than at the top, secured with wrought iron hoops placed 8 feet apart, and planked with 2½ inch planks. The keel is formed of oak; the planks are secured to the hoops by screw-bits driven from the outside, and screwed within with nuts. The two hulls are placed 12 feet 6 inches apart, and there are pine beams within the hulls 2 feet apart, and bolted through the top of each hull with screw bolts, and braced with iron braces from the beam to the bulge of each hull, which are supported with an arch framing fore and aft, braced with diamond braces from the top of each hull to the underside of the arch, and an iron rod is pushed through at the junction of the braces, continuing to the keel, and secured with screws and nuts. The water-wheel, A, 25 feet 6 inches in diameter, is placed 65 feet from the stern, and the deck extends 3 feet at each end over the hulls. The after-cabin is 55 feet in length, and 22 in breadth, containing 32 berths, with a movable partition, which separates three lengths of berths for the ladies. The architect of this enterprising experiment asserts that it will require 15,000 lbs.

* Literary Gazette, No. 907.







(Canadian Twin Steam-boat.)

weight to sink this boat one inch. Her bearings being 60 feet in length by 18 feet in breadth; she will draw, with all on board, wood and water included, 24 inches, and will be propelled by two engines, of 30 horse power, connected with one wheel. The shaft of the water-wheel is placed about 8 feet above the deck, in order to give a 25 feet wheel, and the engines are upon the deck, for the purpose of fastening them better; this produces an angle of about 10°. The air-pumps are within the trunk of the boat, worked by a lever-beam through a hole in the trunk. The boilers, B, are built upon the rail-road boiler principle; the outside of a cylindrical form, of 5 feet 6 inches diameter, with 28 flues of 7 inches diameter, and 13 feet long. A furnace is formed the full size of the outside of the boiler. The whole length of the boiler is 19 feet. They are placed forward of the wheel, side by side, so that one smoke-pipe serves for both. The engines, C C, are outside the boilers: and the wheel, boilers, and engines, are within the space of 46 feet in length by 20 in breadth.*

This vessel was intended to run between the Cedars and Prescott, a distance of 100 miles; and, from her very light draught of water, 31 inches, and very light construction, it was confidently expected that she would have overcome the rapids between these two places without difficulty. A letter from Montreal, dated Sept. 27, 1834, however, states that "her speed, on her trial, did not justify the owners in making the hazardous attempt." The writer (a steam-boat captain), is, notwithstanding, "fully persuaded that they will be successfully navigated in the course of two or three years."

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The following is an outline of the proceedings at the late meeting of the British Association, holden at Edinburgh from the 8th to the 13th of September; Sir Thomas Makdougall Brisbane, K.C.B., F.R.S., &c. &c. President, giving the titles of the communications.

1. *Mathematics and General Physics.*—Chairman, Rev. W. Whewell. —A report by Mr. Challis on the theory of capillary attraction.—On the repulsion produced by heat, as established by the contraction of Newton's rings when heat was applied to the glasses, by Prof. Powell.—Mr. Whewell read a letter from Mr. Hailstone, accompanying a table of barometrical observations, taken at short intervals.—Prof. Forbes read a short communication from Mr. Christie, on a remarkable meteorological phenomenon observed by him at Woolwich.—Prof. Lloyd read to the Section a portion of his report on physical optics.—A paper by Mr. Challis, entitled, theoretical explanations of some facts relating to the composition of the colours of the spectrum.—A paper by Prof. Powell, on the achromatism of the eye.—Prof. Phillips read the second report of the result of twelve months' experiments on the quantity of rain falling at different elevations above the ground, made by himself and Mr. Gray.—A paper by Prof. Stevelly, entitled an attempt to connect some

* From the Montreal Weekly Abstract, July 19, quoted in the Mechanics' Magazine, No. 578.

well known phenomena in meteorology with well established physical principles.—The second part of a report on hydraulics, containing the application of the principles of that science to the subject of rivers, by Mr. Rennie.—On a new method in dynamics, by Prof. Hamilton.—On a new form of the dipping needle, constructed so as to afford the means of correcting the error of the centre of gravity, by Prof. Phillips.—Notes on the mean temperature in India, by Col. Sykes.—On magnetical observations undertaken in Ireland, by Prof. Lloyd.—Sir David Brewster described to the meeting a remarkable coloration which he had observed in the space included between the interior and exterior rainbow.—M. Saumarez read a paper on light and colours, containing some peculiar views respecting their nature and origin.—Mr. Ramage read a proposal for constructing a reflecting telescope of greater magnitude than has yet been attempted.—Dr. Knight exhibited to the Section a method of rendering the vibrations of heated metals perceptible to the eye.—Mr. Russell gave an account of some recent experiments on the traction of boats on canals at great velocities.—Sir David Brewster communicated to the Section the results of a series of experiments on the effects of reflection from the surfaces of crystals, when some surfaces have been altered by solution ; and exhibited a number of singular forms, produced by different crystals, or by the same crystal under different circumstances.—Mr. Graves presented a paper on the theory of Exponential Functions, in further illustration of a memoir on the same subject which he had laid before the Royal Society, and which had been printed in its Transactions.—Prof. Hamilton explained a new method of conceiving imaginary quantities, and the principles of a theory which he denominated "the theory of conjugate functions." Prof. Hamilton stated, that he had confirmed, by the aid of the theory, the results obtained by Mr. Graves.—Mr. Sang stated the results of some theoretical and experimental investigations which he had made on the nature of those curves traced by the extremities of vibrating wires fixed at the end, and he exhibited drawings of the forms of the curves thus produced.—On the production and propagation of sound, by Dr. Williams.—On the visibility of the moon in total eclipses, by Dr. Robinson.—On collision, by Mr. Hodgkinson.

2. *Chemistry and Minerology.*—Chairman, Dr. Hope.—Mr. Johnston and Mr. Harcourt gave an account of the state of the experiments they have respectively undertaken, on the comparative analysis of iron in the different stages of its manufacture, and on the effects of long-continued heat.—Prof. Whewell made a communication from the Committee appointed to examine the subject of isomorphism.—A paper was read by Dr. Charles Williams, on a new law of combustion, and the production of flame at a low temperature.—On the employment of coal-tar in connexion with water as fuel, by Prof. Daubeny.—On the discoveries of Reichenbach in regard to the products of the destructive distillation of organic substances, by Dr. Gregory.—A notice of a large specimen of amber from Ava, intersected by thin layers of carbonate of lime, by Sir David Brewster.—Mr. Van der Toorn gave a determination of the amount of water in crystallized sulphate of zinc. The total amounts to 7 atoms, of which 6 are given off at 110° C., the other atom remaining as a necessary constituent of the salt. From this result he concluded that sulphates, which, at a red heat, give off sulphuric acid, contain an atom of water as an essential constituent.—On the amount of carbonic acid in the atmosphere of the town of Bolton, and the country around, by Mr.

Watson.—On the present state of our knowledge regarding contagion, by Dr. W. Henry.—An analysis of the oxichloride of antimony or crystallized powder of Algaroth, by Mr. Johnston.—The Rev. W. V. Harcourt described the objects of the experiments now in progress under his superintendence, for determining the effect of long-continued heat on various mineral substances, and the various methods adopted by him in disposing them beneath the iron furnaces of Yorkshire.—Dr Clark gave an account of Mr. Nixon's process for smelting iron by the aid of the hot-blast, and exhibited numerical results of the advantages derived from the new process. The saving is so great, that the total amount of coal now necessary to produce one ton of iron amounts only to 2 tons 14 cwt.; whereas formerly it required 8 tons 1½ cwt., being a saving of 5 tons 8 cwt. for each ton of iron produced. This subject was discussed at considerable length.—On the optical characters of minerals, by Sir David Brewster.—An account of an investigation of the constitution of certain hydrated salts, by Mr. Graham.—On a new mode of liquefying the gases, by Mr. Kemp.—On the electro-magnetic condition of mineral veins, by Mr. Fox.—On the dimorphism of the sesqui-iodide of antimony, by Prof. Johnston.

3. *Geology and Geography.*—Chairman, Prof. Jameson.—The Section entered upon a discussion of the views of Dr. Boase relative to stratification, &c., arising out of the last year's proceedings.—Dr. Roger's Report on the Geology of North America was read, illustrated by maps.—A Report by Mr. Stevenson, on the state of our knowledge respecting the relative level of land and sea, and the waste and extension of land on the east coast of England, illustrated by charts and sections of the German Ocean.—Lord Greenock read a paper on the coal formation of the central district of Scotland.—A notice by Mr. Menteath on the Closeburn limestone was read, in which an account was given of the geological, mineralogical, and chemical characters of that deposit.—A notice was read by Mr. Trevelyan, on fossil wood from a bed of clay lying above coal in Suderoe, the most northern of the Faroe Islands.—Dr. Hibbert read a paper, on the ossiferous beds contained in the basins of the Forth, the Clyde, and the Tay. A large collection of fossils connected with this paper were submitted to the inspection of M. Agassiz, and became the subjects of highly important investigation, and communications from him during the sittings of the association.—On the structure of recent and fossil woods, by Mr. Nicoll.—Some remarks on the Geology of the Orkneys, by Professor Traill.—On the Geology of Berwickshire, by Mr. Milne.—Notice of some caverns containing bones near the Giant's Causeway, by Mr. J. Bryce.—A general view of the relation of joints and veins, by Prof. Phillips.—A tabular view of the order of succession of various formations of great thickness, and distinct from each other in their organic remains and mineralogical characters, which rise from beneath the old red sandstone of England and Wales, by R. I. Murchison, Esq.—M. Agassiz delivered some highly interesting observations on the fossil fishes of Scotland.—On the flints found in various parts of Aberdeenshire, and more especially in the vicinity of Peterhead, by Dr. Knight.

4. *Natural History.*—Chairman, Prof. Graham.—A report was read on the recent and present state of Zoology, by the Rev. Leonard Jenyns, F.L.S.—Also, an account of excursions in the neighbourhood of Quito, and towards the summits of Chimborazo and Pichincha, by Colonel Hall.—Prof. Agassiz next made a highly valuable communica-

tion upon the different species of the genus Salmo which frequent the various rivers and lakes of Europe, in which he reduced the species to six. —On the plurality and developement of embryos in the seeds of Coniferæ, by Robert Brown, V.P.L.S.—On the functions and use of the orbital glands of birds of the orders Natatores and Grallatores, by P. J. Selby, Esq.—On the birds observed and collected during an excursion in Sutherlandshire, by P. J. Selby.—On the fishes obtained during the same excursion, by Sir. W. Jardine.—On the insects obtained, by James Wilson, Esq.—On a collection of insects recently received from Java, by James Wilson, Esq.—On the change of colour of the fruit in a certain species of elder, by the Rev. James Drake.—On the cultivation of *Phormium tenax* in Scotland, by John Murray, Esq.—On the progress made in researches on the secretions from the roots of vegetables, by Dr. Dunbar.—On the distribution of the Phenogamous plants of the Faroe Islands, by W. C. Trevelyan, Esq. A memoir on the propagation of Scottish Zoophytes, by Mr. Dalzell.—Account of the Natural History of the central portion of the great mountain range of the South of Scotland, in which arise the sources of the Tweed, by W. Macgillivray, Esq.—On the *coculus indicus* of commerce, by G. Walker Arnott, Esq.—On the head of *Delphinus Deductor*, on the laryngeal sac of the Reindeer, and on a new species of Thrush from Nepaul, by Dr. Traill. —On the transformations of the Crustacea, by J. O. Westwood, Esq.— On a peculiar race of men supposed to have constituted the inhabitants of the elevated regions, situated between the 14th and 19th degrees of south lat., in South America, by Mr. Pentland.—On some peculiar secretions and elaborations, viewed in connexion with the ascent of the sap, by John Murray, Esq.—On a new species of Pecten, by T. Brown, Esq. —On the progress of successive vegetation, at various heights, on the Himalaya mountains, by J. F. Royle, Esq.—Some observations on the structure of feathers, by Sir David Brewster.

5. *Anatomy and Medicine.*—Chairman, Dr. Abercrombie.—Mr. Broughton read to the Section the results of an experimental inquiry respecting the sensibilities of the nerves of the brain.—Dr. Alison read a notice of some experiments by Dr. J. Reid, illustrating the connexion of the irritability of muscles with the nervous system, with observations by himself.—On certain peculiarities in the circulation of the Porpoise illustrated with preparations, by Dr. Sharpey.—A communication from Mr. Murray, of Hull, on the change of colour in the Chameleon.—An abstract of a registry kept in the Lying-in Hospital of Great Britain-street, Dublin, from the year 1758 to the end of 1833, and which illustrated the importance of thorough ventilation in such establishments, by Dr. Joseph Clarke, of Dublin. The author died in Edinburgh during the meeting of the Association.—Dr. W. Thomson read a paper on the infiltration of the lungs with black matter, and on black expectoration, occurring in coal-miners, iron-moulders, &c.—Sir C. Bell delivered a discourse explanatory of his views of the functions of the nervous system, and of the manner in which this department of physiology should be studied.—On the varieties of mechanism by which the blood may be accelerated or retarded in the arterial and venous systems of the Mammalia, by Dr. Aitkin.—Dr. Hodgkin read a report on the history of the results of the experimental inquiry respecting the action of poisons, the prosecution of which was committed by the Association at its last meeting to himself and Dr. Roupell.—Report on the present state of physiological science, by Prof. Clarke.

The Rev. Vernon Harcourt, general secretary, stated the results of the proceedings of the general committee on the subjects brought before them for consideration by the sectional committees, as to grants of money, requests for reports on the progress of science, and recommendations of special subjects of scientific inquiry. They had authorized the appropriation of part of the funds of the Association for the purpose of prosecuting particular researches in physical, chemical, geological, zoological, botanical, and medical science, to the extent of 830*l*. They had authorized the application for the continuation of reports on various branches of science to the Rev. G. Peacock, Rev. J. Challis, Rev. R. Willis, Mr. George Rennie, Prof. Rogers, and Mr. Stevenson; for a report on the application of mathematical science to the phenomena of heat, electricity, and magnetism; on electro-chemistry and electro-magnetism, to Dr. Roget; on the zoology of North America, to Dr. Richardson; on the botany of North America, to Prof. Hooker; on the geographical distribution of plants, to Prof. Henslow; on the geographical distribution of insects, to Mr. J. Wilson; on the pathology of the nervous system, to Dr. W. Charles Henry; and on the effect of circumstances of vegetation on the medicinal virtues of plants, to Dr. Christison.*

The next meeting is to be held in Dublin, on Aug. 10, 1835. Dr. Lloyd to be President; Lord Oxmantoun and Prof. Whewell, Vice Presidents; Professors Lloyd and Hamilton, Secretaries.

THE THAMES TUNNEL NEW ARCH.

Several of the members of the Royal Society, among whom were the Marquis de Diny, Count Szechemge, of Hungary, whose exertions to improve the navigation of the Danube, have lately been honourably noticed, F. Chantry, Esq., Dr. Carpue, D. Burton, Esq., Mr. Pepys, Mr. Dolland, Mr. J. P. Roget, Mr. Murchison, Mr. Children, &c., visited the Thames Tunnel in April, for the purpose of inspecting this extraordinary undertaking, and of considering the practicability of the completion of the work.—Mr. Brunel, the engineer, (who is one of the Vice-Presidents of the Royal Society), received the members of that learned body, and conducted them to the extreme end of the tunnel, where tables were laid out, having drawings, &c., showing the whole progress of the work, the great difficulties that have already been overcome in carrying the tunnel above 600 feet under the Thames, and the data upon which the engineer confidently anticipated being enabled to complete this bold undertaking, were the necessary funds supplied.† Mr. Brunel, at considerable length, detailed the exertions that have been used to overcome the difficulties arising from the irruption of the river, and stated, that in the course of the work, the miners had for twenty-seven days pushed on the tunnel over a quicksand. The interest taken by foreigners of talent is shown, by the fact that in a book kept at the extreme end of the tunnel, there are

* Philosophical Magazine, No. 29.

† At the anniversary of the British Association, it was announced by Mr. Brunel, that Government had supplied 250,000*l*. for this purpose.

inscribed the names of scientific men belonging to nearly every city of importance on the continent, and various other parts of the world.

The members of the Royal Society, after leaving the tunnel, proceeded to view the experimental arch, constructed on a new plan, by Mr. Brunel. The structure is built with bricks and Roman cement, and consists of two semi-arches, springing from the same pier, without any support. By this plan, an arch of the greatest span may be constructed without centring, and demonstrating, as the projector observed, the practicability of building a tower of brick-work 50 feet high, and 200 feet in diameter, and sinking the whole gradually in one mass. By this method it is intended to complete the circular and winding carriage approaches to the tunnel. It may be interesting to observe, that of the two semi-arches, one is shorter than the other, and it has been loaded with above eleven tons of iron for the last nineteen months, without any sensible change in its position.*

THE DUBLIN AND KINGSTOWN RAILWAY.

This important work has been completed, or nearly so, within the past year; and a perspicuous description of its line and construction has appeared in the *Dublin Penny Journal*, and been reprinted in a separate form, with illustrative engravings. We abridge the main details, merely premising that Mr. Vignolles is the engineer of this promising enterprize.

Before entering into a more minute description of the road itself, it may be interesting to make a few observations with regard to the locomotive engines, carriages, &c. Six locomotive engines have been built for the Dublin and Kingston Railway: three of these are from the manufactory of Messrs. George Forrester and Co. of Liverpool; and three from the house of Messrs. Sharp, Roberts, and Co., of Manchester. A great and interesting experiment is conducting in these machines, inasmuch as the working parts of the engines are totally different by each house. Messrs. Forrester have horizontal cylinders, fore and hind wheels of unequal diameter, elastic pistons working with improved valves, a small number of tubes in the boiler, &c. Messrs. Sharp, Roberts, and Co., have introduced vertical cylinders, the whole of the wheels alike, bell-crank motion, solid piston, patent valves without friction; numerous tubes, &c. In both, the greatest excellency of workmanship is apparent —both have adopted wrought iron frames, and straight axles, and, it is believed, have avoided all the errors and weaknesses observed in the locomotive engines hitherto produced.

The carriages are of three classes: most of these have been made in Dublin, by Mr. Dawson of Capel-street; and by Messrs. Courtenay and Stephens of Blackhall-place. A few only were made in Manchester. The wheels, axles, &c. were necessarily constructed in England. Trucks are also provided for conveying gentlemen's carriages, &c.

The railway coaches of the first and second class are of rather an ele-

* Printing Machine, No. 5.

gant description ; the third class carriages are superior to those in use on the English railways, and all are to be covered.

DESCRIPTION OF THE LINE OF RAIL-ROAD FROM THE ENTRANCE STATION, WESTLAND ROW, TO KINGSTOWN.

From Westland-Row to Serpentine Avenue.

The entrance-station is on the east side of Westland-row. The design is sufficiently characteristic of a public building without any attempt at embellishment. The chief points worthy of attention are the beautiful granite door-cases, and cornices, from the rocks near Seapoint cliffs, and the light elegant iron roof over the passengers' station.

To preserve the ordinary traffic of the public thoroughfares, the railway starts at an elevation of about twenty feet from the surface, and spans in succession over each street by flat elliptical arches. For the more important streets, smaller arches for the foot-ways have been made on each side of the principal openings.

The intervals between the streets consist of high retaining walls of limestone, obtained from the Donnybrook quarries, the space between which has been filled with sand, gravel, dry rubbish, and similar materials.

The breadth of the railway from Westland-row to Barrow-street, beyond the Grand Canal docks, is nearly sixty feet between the parapets, and is calculated to receive four lines of rails : the two central roads for the going and returning passenger trains, and the two exterior ones, for the coal, granite, timber, and general merchandise-wagons, which will load and unload with great facility at the sides, and without the slightest interruption to the continual stream of the passenger traffic.

The railway is carried across the quays, and a part of the Grand Canal docks, by a granite bridge of three oblique arches of peculiar workmanship. One arch is intended for a future street, marked out, to pass parallel to the docks: a second is for the business of the quays—the third is to pass the boats of the trade, and is provided with a towing-path ranging with the general line of the dock wall. This bridge will form one of the most remarkable features of the works.

Over Barrow-street, the arch is built with what is technically called *knee'd* or *elbow quoins ;* the stones being cut so as to form an oblique or skew bed on the face of the ring, and to return to a square bed within : these quoins are of granite—the rest of the archstones are of the usual limestone. At this place also the rail-road contracts to a breadth of thirty feet, being adapted for two lines only for the remainder of the distance, the breadth between each of the lines of railway track, being as much, however, as eight feet. The bridge over the circular road is square, but across the Irishtown road, the angle of intersection is only fifty-three degrees ; and a granite elliptical arch, built on the oblique principle, has been introduced with good effect. The intervals between the bridges are still sustained by retaining walls, which, however, diminish in height, and the crossing at Haig's distillery is the first accessible point to the rail-way from Dublin. The road-way has been raised by gentle approaches, and passes on the level of the rail-road. We next come to a handsome bridge of three arches across the river Dodder, with a side opening for foot passengers. The rail-road here approaches the surface of the country.

From Serpentine Avenue to Black-Rock.

At Serpentine avenue, the rail-road crosses on the present level of the road, with gates, lodge, &c., as before. All appearance of masonry now ceases: a green sod bank marks the boundary on each side, with a double row of quick-set plants on the top, which, in a few years, will form a fine hedge. Externally, the mound is formed like a light field fortification, with a berm or set off, on which another hedge-row is planted. A very wide and deep trench forms an effectual fence against cattle and trespassers; and thus the line runs on through Simmonscourt fields, crossing Sandymount lane and Sydney parade. At Merrion, the strand road is crossed close to the old baths, with similar protection, but on account of intrusion, the rail-way from Merrion-hall on to the strand is guarded by high stone fence-walls. From Old Merrion to the place where stood the bathing places at Black-rock, the rail-road is elevated across the strand, and at high water appears like a long mole stretching into the sea. To afford additional stability and protection, an increased breadth is given to the banks seaward, which will form a delightful promenade on fine summer evenings. A cross embankment is made from opposite Booterstown lane to the rail-way, to give access to passengers. At Williamstown, the rail-way nearly touches the shore by Seafort Parade, and another access is afforded: while ample culverts allow the water to flow in as usual to the bathing places all along the coast.

At Black-rock, access will also be had by a second cross embankment from the railway to Merrion avenue; and handsome lodges, with waiting-rooms for passengers, will be constructed at this station, as also at the cross bank from Booterstown.

From Black-Rock to Kingstown.

Again occurs a portion of deep cutting, through granite rocks, with a handsome bridge of granite, to the Martello tower at Seapoint, from whence to Salthill the railroad runs at the bottom of Monkstown cliffs. To this extent, terminating on the western pier of the old harbour of Dunleary, the works of the Company are completed, and nearly ready for opening; but the last portion, on which a commencement is now making, yet remains to be described. Four acts or scenes have been passed over, viz.

First, The city, or mural portion, from Westland-row to Serpentine avenue.

Second, The country, or rural district, from that station to Old Merrion.

Third, The isolated sea embankments, as far as Black-rock, and,

Fourth, The coast road portion under the cliffs, and among the rocks, as far as Salthill. What follows, though less beautiful, is not less useful, and may be styled the fifth, or commercial district.

It commences by striking a chord line across a segment of the old harbour of Dunleary, which segment will be filled up.

The old harbour traversed, the railway will pass between the Martello tower and the battery opposite Crofton-terrace. It will here be in deep cutting, and a granite bridge will preserve the communication with the old pier and landing-place, with a considerable improvement in the approaches. Between the battery and the admiralty stores, the railroad will closely border on the harbour. The road then goes at the back of the admiralty stores, and close to the boat-harbour and landing-place of

the Royal harbour, and thence runs to a termination on the large open space opposite the Commissioners' yard and what is termed the Forty-foot-road, being immediately connected with the magnificent quay and landing-place, now in course of construction by Government, for the accommodation of the Post Office and other steamers.

Stations will be erected at this end of the railway; and for the protection of the public, an iron railing will be placed between the railway and the common road, for the whole length of the harbour, from Dunleary to the Forty-foot-road, and such communications will be made across as the harbour commissioners may direct.

Of the manner in which the work has been executed, it is sufficient to observe, that the utmost solidity and severest simplicity mark the entire. The formation of the railway bed consists of layers of gravel and concrete, with longitudinal and numerous cross drains. Immense blocks of granite, at intervals of three feet, support the iron rails, by means of supports called chairs; at every fifteen feet a larger block extends across and unites the two rails together, and the appearance of firmness and solidity is very remarkable in the course of construction, though at the parts which are quite finished off, nothing is to be seen except four parallel lines of iron bars, laid with almost geometrical precision.

On the 4th of October, the first trial of the steam-engine, "Vauxhall," with a small train of carriages, filled with ladies and gentlemen, was made on the line of railway from Dublin to the Martello tower at Williamstown. The distance was about two miles and a half, which was performed four times each way, at the rate of about thirty-one miles per hour. The control over the machinery was complete, the stopping and reversing the motion was effected without a moment's delay.

On the 9th, a train of carriages, crowded with ladies and gentlemen, proceeded the entire length of the line, from the station-house at Westland-row to Salthill. There were eight carriages attached to the train; one of the first class, three of the second, and four of the third class.

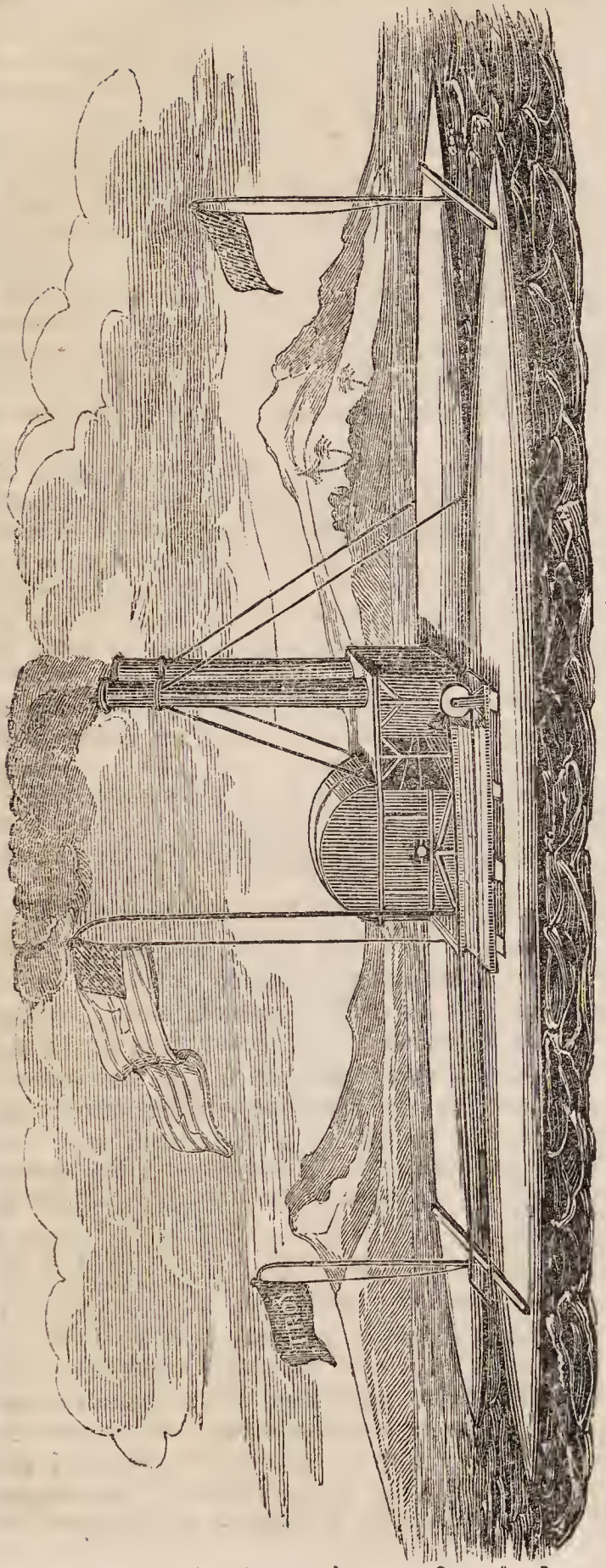
The first trip was made by the locomotive engine, called the Hibernia; and with the many disadvantages attendant on a first starting, the trip, from the engine-house to Salthill, was performed in fifteen and a half minutes, and again back to Dublin in twenty-three minutes.

A second trip was made by the Vauxhall locomotive engine, which performed the journey to Kingstown in fourteen minutes and a half, and back to Dublin in twenty-two and a half minutes.

Several other trials have since been made with the different engines, which have all proved eminently successful.

It is the intention of the Committee of management to adopt various measures of rendering the undertaking productive: the line is ultimately to be carried on as far as Bray; in the meantime, omnibuses are to start from various points throughout the city, while others, again, will ply from Merrion, Black-rock, and Kingstown, throughout the surrounding country. The number of passengers on the road is on the increase every year; and while to the attraction of handsome bathing lodges and villas, erected along the line, is added the rapidity of travelling, and the freedom from dust and rain which the steam-carriages offer over the present mode of conveyance, a vast addition may be reckoned on; and as by the extension of the line towards Bray and southward, the country between Kingstown and Killiney, and the beautiful valley lying between it and Bray, will doubtless be thickly studded with villas and cottages, much may be expected.

THE GREAT AMERICAN STEAM-RAFT.



(The Great American Steam-Raft.)

In the *American Rail Road Journal*, is described a new steam-boat, recently launched at New York, by a Mr Burden, which is stated to have performed, on her first trial, *twenty-one miles in one hour and one minute!* A Liverpool Correspondent of the *Mechanics' Magazine*, spoke with one of the captains of our American packets on the subject, who assured him that he saw her under weigh, and that her speed certainly equalled twenty miles an hour. From the drawing, she consists of two separate hollow trunks or spindles, with a deck laid over them. These trunks are 300 feet long, and in the centre or thickest part, 8 feet in diameter, and taper in a regular parabolic curve to a point at each end. The paddle wheel, which is 30 feet in diameter, works in the space between the two trunks, which is about sixteen feet in breadth.

In the *Rail Road Journal,* the vessel is thus described: "Every person knows that a mass moves more easily through the water endwise than sidewise; and, Mr. Burden has carried the principle to its *ne plus;* instead of building a boat so narrow that she could hardly stand erect, he has made a pair of boats, and so being relieved from all danger of capsizing, he has been able to elongate them to his heart's content. The rudder which is placed immediately behind the flag with the word TROY on it, is only a plate of iron, about 6 feet long and about 5 inches wide, and is governed by the motion of a steering-wheel placed parallel with the boiler, on the same trunk, to which it is connected by ropes, as will be seen in the engraving; it is similar to a common steering-wheel, and, as the chief weight of the parabolic spindles or trunks is in the centre, it causes it to revolve as on a pivot. This may be illustrated by placing a common rolling-pin, used in making pastry, of the same form on a table, and turning it, that will form a complete circle, and on that principle this boat turns, whereas all other vessels turn on their stern.

"From a cross section of the internal part of one of the trunks, the staves, 26 in number, are 3½ inches thick, to each of which is attached an iron bolt, 26 inches in length, passing through the staves, and countersunk on the outside of them. These bolts are fastened to an iron ring by means of nuts screwed on the inside; so that the tighter the nut is screwed, the more compact it makes those staves immediately opposite. Sufficient room is left in the centre for a man to enter and pass for and aft, and to turn the nuts, if necessary.

"We think it right to state another fact in connexion with the advantages which we have enumerated, and that is in her complete exemption from jarring or vibration while under way. The passengers in this boat could easily imagine themselves upon *terra firma,* were it not for her great velocity. It is, we understand, to be named the Emma of Troy. The boilers have been constructed under the direction of the Rev. Dr. Knott."

By a sectional view, it would appear that the two trunks do not project so absolutely apart, like two horns, as here shown, (which would be obviously attended with much practical inconvenience,) but are connected by an outside guard, which incloses the entire structure. In the *Mechanics' Magazine,* it is observed: —"The speed of twenty-one miles in one hour and one minute, was performed, we presume, on the Hudson, but whether with the current or against it, is not stated. As the vessel was built at New York, and Troy is upwards of a hundred miles farther up the river, the probability is that the *first* trial was against the current, which would make the achievement still more extraordinary, being probably equal to twenty-five miles within the hour. The greatest (*authenticated*) speed yet accomplished at sea has not exceeded fourteen knots an hour. A boat of this raft-like description, and of such small breadth compared with its immense length, would hardly answer at sea; neither could it be introduced, except on a very reduced scale, on any of the comparatively tiny rivers of our old world; nor employed any where with advantage, except for the conveyance of passengers and very light goods. The principle, however, is good."

MODE OF ILLUMINATING LIGHTHOUSES.

It is known that Ptolemy, 285 years before the Christian era, constructed the first lighthouse on the island of Pharos; but our readers may not be aware, till within these few years, how much this subject has been neglected, nor how rude were the means resorted to for the purpose of illuminating our coasts. As late as 1811, the Eddystone, near Plymouth, was lighted with twenty-four wax candles; and in 1812, the Lizard lighthouse, certainly one of the most important in the kingdom, was maintained with coal fires. The Bidstone, a leading light to the port of Liverpool, was furnished with an enormous spout-lamp, having a wick twelve inches in width; the smoke from which was so great as to completely darken the upper surface of its reflector. But the increase of trade and the advance of science have, more recently, promoted inquiry and improvement; and we find able men in all commercial countries who have devoted their attention to this subject. Fresnel, De Zach, Aldini, Smeaton, and Brewster, have written upon it; and the result has been, the rejection generally of the barbarous methods referred to, and the substitution of others, which we shall proceed to enumerate.

There are, at present, two principal modes of lighting: the French, the chief characteristic of which is the lens; and the English, which is fitted with parabolic reflectors, hereafter described. Both these systems are by lamps; but we have now Drummonds "new method of illumination," and the gas light.

The French lens, proposed by Messrs. Arago and Fresnel, in 1818, is one of the many great improvements which have been introduced by the "commission des Phares," according to the suggestions of Admiral Rossel, the hydographer of the navy. In this method, the lantern is constructed with eight sides, which form an octagonal prism around the lamp. The centre of each side is occupied by a plano-convex lens, something similar to a burning-glass, having a diameter of about fifteen inches. From there being a limit to the size of the material, this, of itself, is not sufficient to cover the entire side. To remedy this defect, it is surrounded by a series of glass rings, whose external surface is so formed as to have precisely the same optical effect as the great central lens. A transverse section of one of these zones, or rings, presents the form of a wedge, one side of which is slightly curved. In the suggestion of this means of extending the central lens, we are indebted to our countryman, Dr. Brewster, who, in 1811, in the *Edinburgh Encyclopædia*, proved that a lens might be formed of separate pieces. The present ingenious application to the purpose of lighthouses we owe to the French.

It must be obvious that, in this method, it is essential that the light should be in the centre of the lantern, and of the greatest possible brilliancy; and with this view, a lamp has been constructed with three concentric wicks, the external one having a

diameter of three inches and a half. The inventors of this powerful light were, at first, alarmed, lest the extraordinary heat should carbonize the wick; and they devised a means by which the supply of the oil was so much increased, that no bad effect resulted. Mr. Fresnel assures us, that he kept a fourfold socket-lamp lighted for fourteen hours without snuffing it; and that the rays thrown by a lens placed before it, had, at the end of this time, only diminished one-sixth of their original intensity. The Cordovan lighthouse, at the mouth of the Garonne, is illuminated in this manner; and it is generally supposed to be the finest light in the world.

We next come to consider the English method of parabolic reflectors, by which the whole coast of Great Britain is now lighted, and which our neighbours have lately abandoned. This consists of a number of Argand lamps, seven-eighths of an inch in diameter, placed in the foci of reflectors, resembling, in shape, the smaller half of an egg-shell. Their number is regulated by the degree of brightness required. These reflectors are of copper, lined with highly-polished silver, and have a diameter, generally, of twenty-one inches at the mouth, with a depth of nine; a hole is perforated above the flame, for the escape of the smoke, and there is a smaller aperture below, in which the supporter of the socket is inclosed. The first parabolic reflectors were used at Liverpool and Newcastle-on-Tyne; and we owe the invention and application to Captain Hutchinson, a dock-master at the former place. The lighthouses lately erected on Beachy Head, and on the Perch Rock at the mouth of the Mersey, are considered as two of the best specimens of this means of illumination. They are revolving lights, and are provided with thirty of these lamps and reflectors, there being three faces, and ten on each face.

Many experiments have been instituted on the respective merits of these two methods, and, on the whole, philosophers are inclined to give the preference to the more recent invention of the lens. The unalterableness of the glass, and the lasting nature of its polish, are great advantages; and, in point of economy, it is decidedly preferable, as the quantity of oil it expends is one-third less than is used to produce the same quantity of light by the other plan; and an immense deal of labour and chance of neglect is spared, as the glass requires little cleaning, and as there is only one lamp to attend to. But this method is not without disadvantages. The difficulty of repairing the lenses, and the trouble attending on replacing the wicks, is very great; and as the light depends upon one lamp, should any accident occur, the results might prove fatal; besides, it had been remarked, and can be demonstrated, that what the French lens gains in concentration of light, it loses in divergency; twelve degrees is the utmost to be obtained: whereas, in the English method, fifteen is the average quantity; that is, the

English light would be visible on fifteen degrees of the horizon, —the French only on twelve.

We shall next draw the attention of our readers to the plan proposed by Lieutenant Drummond, of the Royal Engineers. It is an invention of which this country may justly be proud, as having elicited results, not only likely to be universally useful to the seamen, but in themselves almost miraculous. The idea seems first to have occurred to this officer whilst employed on the survey of Ireland, where he applied it with great success to the purposes of nocturnal triangulation; and he submitted a paper to the Royal Society, describing his apparatus, which was published in the Transactions of 1826. Subsequently, encouraged by the liberality of the Corporation of the Trinity-House, he extended his views; and a second paper appeared in the *Philosophical Transactions*, in which his discovery was adapted to lighthouses.*

Some experiments have been made of late years respecting the brilliancy of oil gas, and other gases. The use of gas has this great advantage—the size of the flame can be increased to any volume, and it is not liable, in the longest nights, to suffer by the negligence of the keeper; but it as been found, that, by this means, nothing is gained in intensity of light. The process of the gasometer goes on in the wick of a candle, or in that of a lamp. The elements from which it is produced are the criterion of brilliancy, and an equally good material, in both cases, will produce an equal lustre. In 1817, the new lighthouse at Dantzic was lighted with gas, and furnished with a large parabolic reflector. The Austrian government, in 1818, adopted this means, at the suggestion of Nobili; and Salvore and Promontore, on the coast of Istria, are both illuminated by gas. In the centre of the lantern is a candelabrum, provided with forty-two spouts, from which a brilliant body of flame is transmitted.

Experiments have been also made on the relative effects of animal and vegetable oils, when the best spermaceti oil was found to produce the most light. Cocoa-nut oil has been tried, but without success.

For the purposes of distinction, there are three sorts of lights —the revolving, the fixed, and the coloured; and these again are varied by doubling them. A revolving lighthouse, from the light being concentrated, will be seen at a much greater distance than a fixed light, which has its lamps disposed round a circle. Allowing two lighthouses to have an equal number of lamps and reflectors, the advantage in favour of the revolving light would be in the proportion of near three to two; that in the revolving lighthouse would be seen thirty-three miles, while the other would not throw its rays above twenty-two. Some revolving lights have four fronts. The smallest, of this sort, on the coast of England, under the directions of the Trinity-House, has five

* See Arcana, 1831, p. 98.

lamps on a face, and three faces. Buchanness, in Scotland, from the quick revolution of its reflector frame, has the appearance of a flashing light. Mr. Stephenson received a gold medal for this invention, from his Majesty the King of the Netherlands.

Fixed lights are principally advantageous in situations where it is only requisite that small portions of the horizon should be illuminated.

Red lights are obtained in the English method, by placing a red glass before the reflector, which is extremely detrimental to the light, as it has the effect of absorbing most of the valuable rays, viz. the green, blue, and yellow. Red lights are found to be nearly sixty-five per cent. less bright than white ones; and it frequently happens in a revolving lighthouse where two faces are white, and one red, that the red light will not be seen, when the white ones are clearly distinguished; but these lights are found extremely useful for local purposes. In some cases a white, fixed light is arranged so as to have one or more red reflectors, which colour only the rays of light which illuminate the vicinity of shoals, or other dangers, so that the navigator, to be in safety, must keep in the white light. At Caldy, in Wales, a fixed light has been constructed on this principle, having two red reflectors, which indicate a danger in the approach.*

SQUIRREL COFFEE-MILL.

It has been said that there is nothing in the world which might not be usefully employed, if we could but ascertain the specific use to which the powers or qualities of every animate and inanimate object might be appropriated. In the case of the squirrel, a Mr. Bughee, of New York, has devised a method by which its perseverance and activity in giving a rotatory motion to its cylindrical cage might be applied to the useful purpose of grinding coffee. He puts three of these animals into a cylindrical cage of iron wire, three feet in diameter and four feet in length, which, when in motion, acts upon small copper wheels, which turn the handle of the coffee-mill. The power of this machine is so ingeniously calculated, that a single squirrel can, in its play, keep it in motion without apparent fatigue; while, to the simultaneous action of the three squirrels, the resistance is so trifling as to be almost insensible. Mr. Bughee estimates the force which each squirrel exerts, as equivalent to sixty-four pounds. The expense of the machine would (in America) be about six guineas; the maintenance of the squirrels would cost about one penny per day; and the mill would grind a pound of coffee per hour. The profit might thus be easily calculated.†

* Abridged from the United Service Journal, No. 65.

† Musée des Familles.

BEDSTEAD FOR INVALIDS.

THE Silver Isis Medal of the Society of Arts has been presented to Mr. W. Ward, No. 7, Maria-street, Kingsland Road, for his Bedstead for the use of Invalids—a model of which has been placed in the Society's Repository.

The bedstead proper—that is, the frame to which the sacking is looped, is in three pieces, connected with each other by joints. That which supports the head and upper part of the body, may be raised from a horizontal to a perpendicular position; the middle part remains horizontal; and the lower part is capable of being depressed as much as the upper part is of being raised. The invalid may thus be placed in any posture the most agreeable to him, or the most suitable to his case, from a recumbent one to that of sitting upright in a chair.

These advantages are not, indeed, peculiar to Mr. Ward's bed, the novelty of the invention consisting in the due application of a few cords and pulleys, by means of which the above-mentioned different positions are gained. The cheapness and simplicity of the contrivance is its chief merit, as it is not liable to get out of order, and is within the reach of persons in very moderate circumstances.*

ERECTION OF THE YORK COLUMN.

THE subscription for a monument to commemorate the public services of the Duke of York, as Commander-in-Chief of the Army, having, in the year 1829, amounted to the sum of 21,000*l.* (which was afterwards increased, by an accumulation of interest and further contributions, to about 25,000*l.*), the committee of noblemen and gentlemen for managing the application of that fund, invited seven or eight of the most eminent architects in the country to offer their suggestions and to make designs, with a view to the accomplishment of that object. The committee did not, however, decide upon the design till December, 1830, when that submitted by Mr. Benjamin Wyatt was finally adopted. Mr. Newell, the mason, of Grosvenor Wharf, Pimlico, contracted to complete the *column* for the sum of 15,760*l.* 9*s.* 6*d.*, and within two years from his being put in possession of the ground.

Possession of the ground was given to the architect and contractor on April 25, 1831; the excavation for the foundation was commenced on the 27th of the same month, and finished on the 25th of the month (May) following. The peculiar nature of that foundation is not one of the least remarkable among the characteristics of the masterly construction. The ground being in an artificial and a very loose state, to a great depth below the general level of Carlton-gardens, in the part where the column was to stand, it became necessary to remove the loose ground,

* Transactions of the Society of Arts, Part 2, 1833.

and dig to a solid stratum of natural earth, which was not to be had at less than twenty-two feet below the general surface, and from thence to bring up such a foundation as should be fit to receive the enormous weight of the intended column. In the course of only twenty-eight days from the completion of the excavation, a body of *concrete*, consisting of stone-lime, river-stones, sand, coal-ashes, and water, in certain proportions, was formed of sufficient magnitude and solidity to fill up the excavation, and to sustain the vast superincumbent weight of the column; and in seven weeks exactly, from the time at which this body of concrete was commenced, the masonry of the pedestal of the column was begun to be placed upon it.

This artificial foundation was, to a certain degree, of a pyramidal form, its base lines forming a square of fifty-three feet, whilst its top lines formed a square of thirty feet, with all four sides inclining equally and regularly (as towards the apex of a pyramid) from the base to the top. At the height of 11 feet 6 inches above the base line of the concrete, was introduced a strong course of Yorkshire stone slabs, seven inches thick, lying over the whole surface of the concrete at that level—an extent of upwards of forty feet each way—and composed of stones of such magnitude, that nine of them were sufficient to cover the whole superfices, effectually equalizing the pressure from above upon the body of the concrete below. Again, at the top of the line of the concrete, this same expedient was repeated, and another course of Yorkshire stone slabs introduced, to complete the artificial mass which was to form the foundation for the column and its pedestal, and which in a short time became as solid and compact as if it had been a natural rock of granite. Upon this huge, newly-created body of composition (which was completed on the 25th of June, 1831), the first course of masonry was, in only three weeks afterwards, commenced.

The column is of the Tuscan order, and is composed of granite of different colours, all brought from quarries in Aberdeenshire. Its surface throughout is, according to technical language, "*fine axed*," not polished or rubbed.

The pedestal underneath the column consists of ten courses of grey granite, from the quarries of Aberdeen, above the level of the ground, and is 16 feet 8 inches high, to the bottom of the base of the column, having one course of rough granite (from the island of Hern) between the first of these ten courses and the course of Yorkshire stone slabs, on the top of the concrete.

The plinth of the pedestal measures 22 feet 6 inches on either side; and its die is 18 feet and three-quarters of an inch in diameter. The base of the column, consisting of two members only—viz. the plinth and the torus—are formed also of granite from Aberdeenshire, but of a bluer tone of colour than that of the pedestal; and are, together, 5 feet 4 inches in height. The

shaft of the column, which is of red granite, contains twenty-six courses, and has six apertures on one side, and seven on the other, for the admission of light to the staircase within. The bottom diameter of the shaft is 11 feet 7 and a half inches, and that of its top, immediately under the capital, is 10 feet 1 and three-quarter inches; whilst its whole height is 84 feet 10 inches, from the *top* of the basement to the *bottom* of the capital. The capital consists of two courses of the same coloured granite as the base, and is 4 feet 2 inches in height. Upon the outer lines of the abacus of the capital is fixed a plain, but very substantial, iron railing; and in its centre is constructed the acroter, which at once forms a roof, or covering, to the internal staircase, and a pedestal for the statue to stand upon. The superstructure is of the same red granite as the shaft, and contains seven courses in height between the top of the abacus and the foot of the statue. The gross altitude of the whole structure, from the surface of the ground to the top of the acroter, is 123 feet 6 inches; and the statue itself, being 13 feet 6 inches, the whole distance from the ground to the top of the figure, is 137 feet.

The spiral staircase within the pedestal and shaft of the column consists of 168 steps, of 2 feet 4 inches wide, and very well lighted in every part between the pedestal and the outlet upon the abacus of the capital. The architect made use of this staircase for the purpose of firmly binding together all parts of this fabric by means of the bond-stones.

The statue weighs 7 tons 800lbs., and represents the Duke in the robes of the Order of the Garter, the folds of which aid in supporting the ponderous figure. It was conveyed to the base of the pillar on a truck, and was hauled up by ropes and pulleys, the scaffolding for which is stated to have been a triumph of mechanical contrivance. Indeed, it is scarcely possible to reflect on a weight of 16,480lbs. being raised 123 feet in height,* without associating the labour with some of the gigantic labours of antiquity.

The York column, in form, resembles the Pillars of Trajan, at Rome, and of Napoleon, in the Place Vendôme, at Paris. Yet it lacks the interesting character of those celebrated monuments. The rich reliefs are wanting in our column, where all is blank stone; and the merits of the Trajan reliefs, as illustrations of the manners, costume, &c., of the period in which the pillar was erected, are too valuable to be passed over in the comparison.

The proportions of the York column, and that at Paris, are as follow:—

* This extraordinary labour occupied from eleven o'clock A.M. till six o'clock in the evening. The sum to be paid for raising the statue, and placing it on the column, is 400*l.*, the contractor binding himself to make good any damage that might happen to the statue by accident or otherwise. There is no instance of any statue of so great a weight having been lifted to such a height in this country.

COLUMN AT PARIS.	*Feet.*	YORK COLUMN.	*Feet.*
Height - - - - -	141	Height - - - - -	137
Diameter - - -	12 9	Extreme Diam. -	11 7½*

MAGNETIC LOCOMOTIVE ENGINE.

A VERY successful trial of a new magnetic locomotive engine has been recently made by M. Lemaire of Brussels, its constructor. The trial occupied above an hour; and, as the motion was very rapid, it may reasonably be expected that this new power will become of much use when employed on a larger scale. The construction, in which the plan suggested by Professor Guillery has been followed, is very simple, consisting chiefly of an horizontal fly-wheel of copper, which magnetises a galvanic column, within which an iron bar is placed; this bar turns itself between two fixed magnets, and thus works the fly-wheel agreeably with the impulse given by them. As soon as the iron bar has arrived at a balance, the magnetic current has increased so much as to change the poles, and that is now repelled which just before was attracted: by this means, a continual pendulous motion is established. This is the first time, we believe, that the well-known power of the magnet has been made available for the purposes of locomotion.†

VENTS IN GUNS.

IT has long been complained of, that a very large portion of the charge of all pieces of ordnance, from a 13-inch mortar to a pocket-pistol, is expended at the touch-hole in vent, the force of explosion through which has hitherto prevented the use of percussion caps to field-pieces or larger guns; and it has also been deemed a great inconvenience, that no safe means have been invented to stop the vent-holes of guns during the period of their being reloaded, the only stopper now in use being the thumb of one of the men working the gun, the pressure of which is at all times uncertain, and forgetfulness to apply which has frequently been the cause of melancholy accidents. A very simple, but at the same time most certain, remedy for those evils has been shown us, the joint invention of Mr. Bartholomew, of Titchfield, and Mr. H. Clarke, of Portsmouth: it consists in the introduction of a pin through the metal of the bore ring and grooved into the vent-field, and fits so close to the vent-hole as to be air tight. A small portion of this pin is perforated at the end, and an opening in the side communicates with the touch-hole; at the perforated end is fitted a percussion cap, the fire from which is sufficiently strong to ignite the cartridge, and as the pin remains in its place, the vent is never unclosed. The mode of striking

* From the Mirror: the details from authorized sources.

† Printing Machine, No. 13.

the pin, when the gun is to be discharged, is ingenious and simple, and is done by a man who stands behind the gun, with a lanyard in his hand, as he now does when he pulls the trigger of a lock. By this contrivance, no loose powder nor quill tubes are wanted, by which many accidents have happened. No accident can happen in the re-loading the gun from the vent being unstopped; the rapidity of firing is increased, as the cartridge does not require to be pricked, and the percussion fire is thrown to the centre of the bore of the gun, and quite into its extremity, and not to the top of the cartridge, as at present; by which means all the cartridge will be driven out, and the piece will not require sponging at every discharge. It will be a great saving of powder, for as none is lost through the vent, either less will be required, or the shot will be thrown further: it is calculated this will make 25 per cent. difference. The invention is sanctioned by the Admiralty Board, and is about to be tried on board the Excellent. Such officers as have seen it have been much pleased with it, and highly recommend its adoption. A number of the members of the Yacht Club have also declared their intention of having this *self-serving vent-pin* applied to the guns in their yachts.*

NUISANCE OF SMOKE.

Several German publications contain allusions to the discovery of a new and certain method of remedying all inconveniences occasioned by smoke in great towns. Though the means by which this important object is accomplished are not explained, the investigation the subject has undergone seems to leave no doubt as to the successful result of the experiment. It seems that the heads of the Prussian Post-Office have established an extensive manufactory for mail-carts and carriages at Dusseldorf. The smoke of this manufactory greatly annoyed the inhabitants of the neighbouring houses, and the soot which fell destroyed their garden grounds. Actions were brought against the Post-Office Department, and the Government was on the point of removing the manufactory, when Herr Bernhardt discovered a chemical process which separates the soot from the smoke, directs the ascent of the latter in a perfectly purified state, and makes the former descend in a manner which keeps the chimneys clean, and is a security against their taking fire.†

NEW SAILING VESSEL.

We have just seen the model of a vessel, constructed on the principle of a steam-packet, propelled by paddles; but from its peculiar mechanism, it completely supersedes the necessity of steam. The given power is communicated by four revolving

* Hants Telegraph. † Printing Machine, No. 12.

sails (gigot shaped), placed over the centre of the boat, which are acted upon by the wind from any point whatever, without in the least interrupting the progress of the vessel. The serious consequences often arising from the effects of sudden squalls are hereby completely obviated, from the accelerated horizontal action which the sails acquire, one counteracting the weight of the other in a direct ratio. This invention will also be of infinite utility in the construction of mills used in every description of manufacture. In fact, we deem it one of the most important discoveries of modern times. The inventor, Mr. John Willis, intends taking out a patent for the discovery.*

BRONZE MANUFACTURES IN FRANCE.

During the last thirty years, the manufacture of bronzes has acquired considerable importance in France; and as this branch of industry owes the impulse it has received to the good taste of the French artists, it has had no competition to encounter in foreign markets. The principal seat of this manufacture is at Paris, where so many as 250 houses are exclusively engaged in the manufacture of every description of articles in bronze. The number of workmen is estimated at 5,000; and if we add to them the gilders, who form a distinct body, the number of persons—masters and workmen—who find in the bronze manufacture a steady and lucrative occupation, will amount to nearly 6,000. The manufacture is estimated to produce annually the sum of about 800,000*l.*; of which from 400,000*l.* to 500,000*l.* is the value of articles sold in France, and from 280,000*l.* to 320,000*l.* the price of articles exported to foreign countries. At Paris, there are made every year 15,000 bronze clocks, 40,000 pairs of candlesticks, 3,000 pairs of candelabras, and 100 *surtouts de table.*† It would be desirable to include in this enumeration the glass covers for the clocks, lamps, &c. &c. The number of glass cases annually required for such purposes is estimated at 60,000. For some time past the use of bronze in the manufacture of chandeliers and lamps has become very common, and the employment of the article is daily becoming more extensive both for ornament and use. The division of labour is now established on a large scale in this branch of manufacture; and many founders employ a large number of workmen in making one particular part of an article. The importance of the manufacture of articles of luxury in bronze, some beautiful specimens of which appeared in the great exhibition of French machinery and manufactures at Paris, a few months since, cannot be estimated

* Wexford Independent.

† "*Surtouts de table;*"—by this we understand large ornamental vases for holding flowers, which are placed in the centre of the table at large dinner-parties.

with so much precision as that of the bronzes of commerce, as it depends on particular circumstances which do not act with regularity. The following statement is given in reference to the bronze manufactures of Paris alone :—

15,000 clocks, at the average price of 10*l.*	£150,000
40,000 pairs of candlesticks, at 16*s.*	32,000
3,000 pairs of candelabras, at 8*l.*	24,000
100 *surtouts de table*, at 60*l.*	6,000
60,000 glass covers, at 8*s.*	24,000
Chandeliers and lamps	40,000
Small articles	72,000
Articles of luxury	80,000
	£428,000

Since the founders have employed, in the manufacture of ornamental bronzes, one-third of zinc, the cost of which is less than that of copper, the price of the material, and consequently of the articles manufactured from it, has been reduced, and the demand has increased in proportion.—*Exposition des Produits de l'Industrie Française en* 1834.*

ERICSSON'S CALORIC ENGINE.

At the Royal Institution, on February 14, Dr. Faraday introduced a conversation on Ericsson's caloric engine. He commenced by stating that he felt himself placed in a position of considerable difficulty in bringing forward a subject on which such difference of opinion existed; yet the objects of this institution was the philosophy of a question not to decide on the probable result in a mercantile point of view, of any invention or engine which might be brought forward, and in explaining the principles of Captain Ericsson's invention, he trusted that he should not be held responsible for the correctness of the various propositions which he would have to make; at the same time he was bound to state, that, prior to the construction of the engine, one part of the invention was submitted to his opinion, and he had reported favourably; and this was the possibility of transferring the heat contained in a current of air passing in one direction to another current of air passing in an opposite direction (separated only by metallic surfaces); but how far this might be usefully and economically employed in obtaining an engine of power, it was not for him to determine; this question would be brought to a fair test when an engine of 50 horse power, now constructing, shall be set to work. Dr. Faraday then described the manner of transferring heat from one current of air to another by working models, and afterwards, by the aid of working diagrams, he explained the construction of Captain Ericsson's

* Printing Machine, No. 19.

engine. Our having given a full account of this engine,* will render it unnecessary again to describe the principles on which this invention is proposed to work. Dr. Faraday having explained the various bearings of the question, concluded by observing that he was bound, in justice to his own character, to make a remark, which he regretted the more that it was possible and probable, had he been able to see Captain Ericsson prior to his entering into this explanation, he would have been able to remove a doubt and difficulty which he (Dr. Faraday) must confess he could not clear up to his satisfaction; this had been prevented by the serious illness of Captain Ericsson. What he referred to was, that he could not clearly see how the difference of pressure, stated by the inventor to exist, could be maintained in the different parts of the apparatus.†

EXHIBITION OF FRENCH MACHINERY, MANUFACTURES, &c.

THE first attempt of this kind was made by M. François de Neufchateau, when minister of state, in September, 1799. There have been seven exhibitions, at intervals varying from four to eight years, since his time; but the Bourbon Restoration interrupted their continuance. In 1819, however, they were resumed, and the exhibition of that year was spoken of by one of our own prints as lending a greater triumph to French industry over that of neighbouring states, than any victory gained by Napoleon's armies. Until the present season there had been none since the year 1827, when the specimens exhibited were sufficient to fill eight-and-twenty apartments in the Louvre; in fact, so great was the number sent in, that the jury of arbitrators were compelled to refuse admission to a multitude of interesting articles, and induced to fix the next exhibition for the year 1830. But a spectacle of a very different nature engrossed the attention both of government and subject on that day; nor was an opportunity found for a renewal of the scene until the present spring, which forms its eighth occurrence. In order that no disappointment, either to the parties interested or the public, should arise on this occasion, it was determined that four large lodges, each containing three galleries, should be constructed on the Place de la Concorde: the intervals between them being filled up with colonnades of columns and pilastres of the Tuscan order. These temporary buildings (for they are merely of wood) have cost above sixteen thousand pounds; the roofs are covered with zinc, the hundred columns and pilastres are of finished and ornamental workmanship; and the porticoes of entrance, as well as the windows, are constructed with as much solidity as if they had been designed to last for ages. Every lodge is appropriated to

* See Arcana, 1834, p. 12.

† Repertory of Patent Inventions, &c., No. 3.

some particular department: the first, to machinery and mechanism on a large scale; the second, to such as are on a small scale, instruments of all kinds, watches and clocks, and specimens of metal and glass work; the third, contains what are called Parisian articles, objects of mere taste and luxury, toys, &c.; and the fourth is exclusively composed of the produce of French manufactories. The whole list extends to the designation of two thousand four hundred different artists and manufacturers, and upwards of two hundred thousand specimens of our neighbours' skill and industry. In this respect it has greatly the advantage over the exhibition of 1827, when about one hundred and twenty thousand specimens, the production of one thousand seven hundred and ninety-five individuals, were submitted to public view.*

MACHINE FOR SILVERING LOOKING-GLASSES.

The large Silver Medal of the Society of Arts, and Five Pounds, have been presented to Mr. George Farrow, of Silver-street, Golden-square, for his Machine for Silvering Looking-glasses—a model of which has been placed in the Society's Repository.

The common silvering-table for looking-glasses is a slab of stone, ground to the most perfect degree of evenness, and placed in a frame so that a certain degree of obliquity can be given to it. All round the margin is a gutter, through which, at one corner, a hole is made, so as to allow the escape of the mercury when the plug that closes the hole is removed. It is this corner which is lowest when the oblique position is given to the table, in order that the mercury may run to it from the other parts of the gutter. On the silvering-table is spread a sheet of tin-foil, of the same size as the glass, or rather a little larger; a fluid amalgam of tin is then poured on it, and spread over its surface with a brush till it adheres; more mercury is then poured on, till it stands about a quarter of an inch deep over the tin-foil. The plate of glass being previously made quite clean, is then slid gently and steadily from a sheet of paper, just dipping below the surface of the mercury, but avoiding to touch the tin-foil, for fear of tearing it. When the glass is fairly over the tin-foil, the table is placed a little oblique by means of a rack; the mercury now runs into the gutter, and the glass subsides on the tin-foil. The whole surface of the glass is then covered with leaden 7-lb. weights, having cloth at the bottom. By this pressure, at the end of twenty-four hours, the silver is so firmly adherent to the glass, that the weights may be removed, and the glass raised up in a sloping position, to allow the mercury to drip off, till the silvering has become quite hard.

Mr. Farrow's improvement consists in dispensing with the loose leaden weights, and in producing the required pressure

* Printing Machine, No. 12.

by means of screws. It is attended with the following advantages:—First, all hazard of breaking the glass during the application of the pressure is avoided; when loose weights are used, one will sometimes slip out of the hand of the workman, and, falling on the glass, will break it; secondly, the plate, as soon as the pressure is made by means of the screws, can be tilted up, even in a vertical position, so as to expedite considerably the drip of the mercury from silvering—an operation which is manifestly impossible where loose weights are employed.

Mr. Farrow himself has, hitherto, applied his invention only to small plates for dressing-table glasses; but Mr. Wheeler, a manufacturer of looking-glass, has applied Mr. Farrow's apparatus, with some modifications, to plates 47 inches long and 29 inches wide.*

NEW METHOD OF LIGHTING THEATRES.

A NEW method of diffusing light through a theatre has been discovered by a mechanist at Venice. By the aid of parabolic mirrors the light of many lamps is concentrated over an opening made in the ceiling of the theatre, and reflected down on a system of plano-concave lenses, of a foot in diameter, which occupy the aperture, and convey into the theatre the rays of light which arrive at them parallel and depart from them divergent. From the pit the lenses are alone perceived, which resemble a glowing furnace; and although the luminous focus is sufficient to light the whole of the theatre, it does not dazzle, and may be viewed without fatiguing the eyes. The apparatus, being entirely concealed, accommodates itself readily to all the changes which the representation can require. It likewise occasions neither smoke nor bad odours, and has none of the inconveniences of the ancient system.†

PRIZE CHRONOMETERS.

THE eleventh annual trial of chronometers at the Royal Observatory is signalized from all the preceding by the circumstance of the first premium of 200*l.* not having been gained. The successful chronometers were, Appleton, No. 145, for the second premium of 170*l.*; and for the third, of 130*l.*, Mr. Molyneux's, No. 1263. It must not be inferred from the above circumstance, that the art has deteriorated, for it is gratifying to find that the trial numbers of these two chronometers are both less (excepting those of the trial of 1832) than any of the preceding. But it must be attributed to the very narrow limits of the trial number, and the uncertainty, even in the present day, that exists of producing a good chronometer. Messrs. Arnold and Dent have shown that

* Transactions of the Society of Arts, Part 2, 1833.

† Printing Machine, No. 10.

the best chronometer-makers cannot surmount difficulties that lie in their way regarding the material of which chronometers are at present constructed, and that all is uncertainty until proved by experience. We are not without our hopes, founded on good grounds, that all these difficulties will eventually be removed by their glass balance-springs.* Should this succeed, as is our opinion it will do, a better chronometer than has ever yet been made may always be commanded, and that at no exorbitant price.

The present trial numbers are as follow:—

For the 1st premium of £200, not exceeding $2\frac{1}{2}$ seconds.
..... 2nd ..... £170, ... $3\frac{1}{2}$ .....
..... 3rd ..... £130, ... $4\frac{1}{2}$ .....

ON THE EFFECT OF IMPACT ON BEAMS.

By Eaton Hodgkinson.

The author gave the results of some inquiries into the power of beams to resist impulsive forces. The experiments were made by means of a cast-iron ball, 44lbs. weight, suspended by a cord from the top of a room with a radius of 16 feet. The ball, when hanging freely, just touched laterally an uniform bar of cast iron, sustained at its ends in a horizontal position by supports under it and behind it, four feet asunder. The intention was to strike the bar, sometimes in the middle and sometimes half-way between the middle and one end, with impacts obtained by drawing the ball and letting it fall through given arcs, shifting the bar when the place of impact was to be changed, and obtaining the deflections of the bar at that place by measuring the depth which a long peg, touching the back of the bar, had been driven by the blow into a mass of clay placed there. The results were:—

1. The deflections were nearly as the cords of the arcs through which the weight was drawn, that is, as the velocities of impact.

2. The same impact was required to break the beam, whether it was struck in the middle, or half-way between the middle and one end.

3. When the impacts in the middle and half-way between that and the end were the same, the deflection at the latter place was to that at the former nearly as three to four, which would be the case if the focus of ultimate curvature, from successive impacts in every part, was a parabola.

The preceding deductions the author had found to agree with theoretical conclusions, depending on the suppositions, (1,) that the form of a beam bent by small impacts was the same as if it had been bent by pressure through equal spaces; and (2,) that the ball and beam where struck, proceeded together after impact as one mass. These suppositions likewise gave as below:—

4. The power of a heavy beam to resist impact is to the power

* See Arcana, 1834, p. 49.

of a very light one, as the sum of the inertias of the striking body and of the beam is to the inertia of the striking body.

5. The time required to produce a deflection, and, consequently, the time of an impact, between the same bodies, is always the same, whether the impact be great or small. The time, moreover, is inversely as the square root of the stiffness of the beam.

6. The results of calculations, comparing pressure with impact, gave deflections agreeing with the observed ones, within an error of about one-eighth or one-ninth of the results.*

THE PIANOFORTE.

There is no musical instrument which has undergone so many alterations as the piano. It is not, as has been often said, an improvement of the harpsichord, for that instrument consisted of strings, strung by mechanism, and did the duty of a large lute, its system of keys furnishing harmonies such as could not be obtained but with great difficulty on the common lute. The piano differs in principle; for it is the application of a system of keys to the dulcimer, the heads of the rods of which struck the strings. The oldest specimen of this kind of instrument known to exist, is the harpsichord with hammers, invented by a manufacturer of Paris, named Marius, at the beginning of the eighteenth century. This invention did not attract much notice, nor does its author appear to have been at all aware of its importance; he thought that he had done no more than contrive a modification in the harpsichord. A few years after this, viz. in 1716, Christophori, of Padua, reproduced Marius's instrument with some improvements, under the name of the *Cemballo Martelleto*, but with scarcely better success than his predecessor; for the lovers of the harpsichord would not consent to abandon their long established favourite. Whilst Christophori was thus engaged, Amadeus Schroeter, an organist of Nordhau sen, endeavoured to construct a keyed instrument, the strings of which were struck by hammers; to this he gave the name of *Pianoforte*, and the honour of the invention has abided with him. It was not, however, adopted by musical performers till about the middle of the eighteenth century, after Godfrey Silbermann, of Freyburg, had further improved it. This manufacturer, and Johannes Stein, of Augsburg, first made it an article of trade. Other German manufacturers, established in England, made many of these instruments, and those few which were to be found in France were of their manufacture. About 1775, Sebastian Erard and his brother came from Strasburg to Paris, and began to construct the small pianos, which were the foundation of their reputation.

* Report of the Third Meeting of the British Association for the Advancement of Science.

Their instruments differed from the German and English model in the introduction of the brass spring, which fixed the extinguisher on the string, and the substitution of pedals instead of the registers used to modify the loudness and tone of the sound. The first that is supposed to have come out of their workshop bears the date of 1778. Since that time, the Erards have been constantly making additional improvements on the piano.*

NEW LOCOMOTIVE MACHINE.

Mr. Akrill, a very ingenious mechanic of Boston, has discovered a mode by which a person may easily propel himself on common roads, at a speed of from eight to ten miles per hour, without any expenditure in material, save the cost of the carriage. The construction of the vehicle is remarkably light; the body is on four wheels, and the impetus is effected by the pressure of the feet upon some concealed machinery, the nature of which the proprietor keeps a secret, though he willingly shows the carriage to any persons except professed mechanists. At an elevation of about four feet the conductor sits, and he is enabled to guide it with the utmost accuracy; to suspend the motion in an instant; to turn it to the right or left, or to give it a backward progress. Besides the mechanical power, however, the inventor has called the winds to his aid; for should the traveller be favoured with propitious gales, he can, by the introduction of a common umbrella in front, avail himself of an additional accelerator, the lightness of the vehicle, and the elevation of the conductor, rendering the least breeze sufficient to give the carriage an onward progress. Important as this invention is on its own account, however, it is doubly so because it contains a principle which the projector declares will nearly abolish the friction, which has ever been so great a drawback to the powers of the steam-engine, and the removal of which will increase the powers and diminish the cost of these engines to an almost incredible extent.†

RECOVERY OF TREASURE FROM THE WRECK OF THE THETIS.

On February 27, the Hon. Commander de Roos read before the Royal Society the following account of this successful enterprise:

The author, who had the command of his Majesty's ship Algerine, was instructed to take charge of the enterprise commenced by the officers and crew of his Majesty's ship Lightning, having for its object the recovery of the treasure and stores from the wreck of the Thetis, which, in the month of December, 1830, had sunk in a cove to the south-east of Cape Frio. He reached this spot on the 6th of March, 1832, having with him eleven officers and eighty-five men. A certain number of men were

*. Printing Machine, No. 15. † Lincolnshire Chronicle.

appointed to remain on board the ship, which was moored in a harbour two miles off; a party of artificers and others were employed at the huts which they inhabited near the Cape; and the rest, nearly thirty-five in number, were stationed at the wreck.

The author gives a description of Cape Frio, and of the island of which it forms the south-eastern extremity, which is an immense promontory of insulated granite jutting into the Atlantic Ocean, sixty miles east of Rio de Janeiro. The cove, in the middle of which the wreck of the Thetis lay, is a square indenture in the cliffs, six hundred feet deep by as many wide. It is surrounded by nearly perpendicular masses of granite, from one hundred to two hundred feet high, and is exposed to the whole swell of the South Atlantic, which sets in with remarkable force in that direction. The weather is singularly variable; and transitions frequently take place in the course of a few hours, from perfect stillness to the most tremendous swell. The author states that he has witnessed few scenes in nature more sublime than that presented by the Thetis Cove during a gale of wind from the south-west.

The author enters into a minute description of the mechanical apparatus employed for obtaining the necessary purchases for the various operations which were required, and gives a circumstantial history of his proceedings. Frequent interruptions were experienced from the state of the weather, and the almost incessant agitation of the water, which was often so powerful as to render the diving-bell unmanageable, and to expose the divers to serious danger. The diving-bell consisted of a one-ton ship's water-tank, with eight inches of iron riveted to the bottom in order to give it more depth, and having attached to it eighteen pigs of ballast, the weight of which (17 cwt.) was found to be sufficient to sink it.

As soon as the necessary arrangements had been completed, the author states that he made a minute survey of the bottom, by means of the diving-bell, and ascertained the exact position and shape of all the large rocks which covered the spot where the treasures and stores of the Thetis had been scattered. The shape of the area where the precious metals in particular had been deposited, was an ellipse, of which the two principal axes measured 48 and 31 feet; and large boulders of granite had been subsequently rolled over these treasures, and required being removed before the latter could be recovered. The superincumbent pressure of the sea, aided by the huge materials of the wreck of the frigate, which, under the influence of the swell, had acted like a paviour's hammer, with enormous momentum, had jammed together the rocks, and produced a strong cohesion between the fragments of wood, and the gold, silver, and iron.

The first object was to clear away every portion of the wreck; and after this had been accomplished, to loosen and remove all the large rocks in succession, beginning with the smallest, and

ending with the largest and most unwieldy. Some of these, which they succeeded in rolling from their situations into deeper water, weighed about thirty or forty tons; and the largest, which required the greatest efforts to move from its place, was computed to weigh sixty-three tons. This last effort served to show, that no part, either of the wreck or the stores, which was of any value, remained behind; and after fifteen sixteenths of the property had been recovered, the enterprise, which had so perfectly succeeded, terminated on the 24th of July, and the Algerine returned to Rio de Janeiro on the 1st of August.

The author subjoins an account of the currents off Cape Frio, and a description of the climate, which seems to have been favourable, for his party suffered but little from sickness, and the expedition was unattended with the loss of a single life. On one occasion the party were visited by a whale, which approached very near the diving-bell, but fortunately changed its course, without doing any mischief.

FRENCH AND ENGLISH SILKS.

The "Chamber of Commerce" of Lyons has had the good sense to open an exhibition of the silk manufactures of other countries; and we give the following as the result of a comparison between the French and English, as stated by our neighbours themselves:—"With the exception of *plain* goods, the Lyonese may dismiss the apprehensions under which they have hitherto laboured. The English are, we own, our rivals as to plain silks, and sell their Gros de Naples and Levantines at a lower price than ourselves in the American markets. It will, however, appear, upon examination, that in the first and chief place, they are inferior both in dye and finish, particularly the black kinds; in the second, that they are less uniform in their texture, and readily fray and unravel; and in the third, that the slightest drop of rain draws up the material in a most extraordinary manner. The Spitalfields goods are better manufactured than the Lancashire, but a higher price is paid for them. With respect to *ribbons*, it must be allowed that Coventry has made rapid strides of late years; and St. Etienne must redouble its exertions, unless its manufacturers be inclined to suffer their rivals to get the start of them. The latter are still incontestably superior to them in point of design; but their rivals are taking the best course, by instituting schools for the education of better artists, to place themselves on an equal footing with them. Lyons relies upon its genius; but if what Buffon says be true, that 'labour is genius,' it is necessary for the merchants and operatives of this place to keep that axiom perpetually in view."*

* Printing Machine, No. 19.

REFLECTING TELESCOPES.

Means by which Sir John F. W. Herschel has rendered large Reflecting Telescopes applicable to the nicer purposes of exact Theoretical Astronomy.

In the second part of the *Philosophical Transactions* for the past year is an elaborate paper by Sir John Herschel, consisting of observations of nebulæ and clusters of stars, made at Slough, with a twenty-feet reflector, between the years 1825 and 1833. An appendix explains the manner in which the reduction of the observations, of which the paper itself is a collection, has been executed by the author. It is in the course of this explanation that the final improvement of the reflecting telescope is described. A difficulty presented itself in the reduction of the observed polar distances to mean polar distances at a fixed epoch, arising from considerable fluctuations in the value of a certain expression which was a function of the times of the transit of the objects observed over the vertical wires of the eye-piece of the telescope. These fluctuations in value, to which the function alluded to was found to be liable in very variable degrees at different epochs of the observations, were occasioned by instability of the instrument, which was partly due to hygrometical changes, but by far the worst and most intractable part of the fluctuations appeared "to have taken its rise from the shifting of the line of collimation, owing to the mirror taking a new bearing in its cell." "I regret," continues Sir J. Herschel (*Phil. Trans.*, 1833, p. 488), "that I did not earlier perceive this cause of error. It has only recently occurred to me, and the remedy almost at the same instant suggested itself in a simple, and what I trust will hereafter prove an effectual application, of the collimating principle of Rittenhouse and Kater. It consists in attaching to the *inside* of the wooden tube of the reflector a small achromatic telescope, having its object-glass turned towards the speculum, and its eye-end projecting at right angles to the axis of the tube through an aperture in the side, the cone of rays being deflected outwards at a right angle by a small mirror 45° inclined to its axis. In the focus of the object-glass (thus rectangularly deflected), is fixed a cross of fine spider-lines, strongly illuminated by a lamp (capable of being shut off when not wanted), which also serves to illuminate the field. The cross is so situated that its image, seen in the telescope as an object infinitely distant, (according to the principle of the collimator,) makes with all its arms, angles of 45° with the horizontal and vertical wires of the sweeping eye-piece. In the beginning of a sweep, the intersections of both crosses are brought to exact coincidence (by a method presently to be explained); and it is evident that if in the progress of the sweep the slightest shifting of the mirror in its cell should produce a motion of the line of collimation, it cannot fail to be detected by the apparent recess of the two crosses from their

original common intersection. A relative motion, to the amount of two seconds of space, either laterally or vertically, cannot possibly escape detection, as I have convinced myself by many trials; and so satisfactory has this mode of overcoming the difficulty in question proved, that I have no hesitation in saying that the only obstacle to the use of large reflectors for the nicer purpose of exact theoretical astronomy (viz. the error caused by the shifting of the mirrors in their cells, by reason of their great weight, and the danger of securing them by strong pressure) has ceased to exist. It is not, however, sufficient to have the means of readily detecting error, without possessing that of correcting it with equal readiness, or at least measuring its amount. A very simple and effectual contrivance accomplishes this. The two adjusting screws by which the mirror-case is supported against the bottom of the tube are terminated, outside of the latter, by large disks or wheels of wood about six inches in diameter, grooved at their edges. Round these, re-entering cords are conducted over pulleys, to a convenient point within reach at the mouth of the tube, forming a kind of reins, which hang loose when not in use, but by tightening or drawing one or other of them, any motion, however large or minute, may be given to the line of collimation at pleasure. By the aid of this mechanism, the perfect adjustment of the line of collimation (to the full extent of the optical powers of the instrument) is performed in an instant, and may, if we please, be repeated at every observation, being attended with no trouble. Nay, the line of collimation may be purposely deranged to any extent, and immediately corrected. So that by graduating the grooved disks, and adopting an index to each, a very complete distance and position micrometer for the measurement of double stars might be formed, in which, if necessary, two lucid points might imitate the two stars to be compared."

To the foregoing account of his application of the collimating principle, Sir J. Herschel annexes the following note:—

"My first collimator consisted of a small object-glass, by Fraunhofer, of about one inch and a half in diameter, and twelve inches focus. When applied to the twenty-feet reflector, as described in the text, it formed an admirable microscope with its full aperture,—an extraordinary proof of the perfection of its construction, this being doubtless the severest test to which an achromatic object-glass can be possibly subjected. The most beautiful object I can remember to have seen in telescopes was Jupiter entering, perfectly defined, and with all the appearance of a real globe, into the image of a small glass globule, placed in the focus of the collimating telescope. It seemed like the mutual penetration of two solids, or rather two essences of different natures, the one bright and ethereal, the other dark and adamantine. This most exquisite specimen of workmanship was destroyed by an accident. That with which I

have been forced, temporarily, to replace it, bears no comparison with the original."*

WOODEN CLOCK.

The *Boston Herald* mentions a curious wooden clock made by a carpenter of Spalding, of the name of Lancaster, lately deceased. It is wholly made of wood, with the exception of the swing-wheel and the hands, or pointers. It shows the time of the day, and strikes the hours. It also shows the periodical revolutions of six of the primary planets of the solar system, by six indexes pointing to six rows of figures, marked on a dial-plate for the purpose. This article was made by the ingenious mechanic without any other tools than those used by carpenters and joiners at their usual business, with the exception of a file; and without the assistance or advice of any person whatever. Curious or incredulous persons are invited to inspect the clock at the residence of the maker's widow in Spalding.†

CHINESE INVENTIONS.

It appears, from the recent communication of a correspondent at Canton, to the *Morning Herald*, that the Chinese have been, for the last quarter of a century, *unjustly low rated;* which the writer attributes to the little intercourse of Europe with China, except through England, and that through persons whose interests have been served by keeping up delusion on both sides. A few minor agricultural implements and contrivances to supply the cravings of the luxurious rich, may serve to exemplify this mistake. For all practical purposes, of colours, or tests of metals, the Chinese are equal to the manufacturers of London or Paris. The Persian wheel waters and fertilizes whole districts. Dempster's scheme for preserving fish in ice, (adopted in Scotland in 1800,) feeds the alderman about lat. 28° N., from the snow of the steppes, with delicious north country fish; and has existed for centuries. Wheels driven by crews, keep in life and freshness by a stream of water thousands of fish brought into boats by the Canton market daily, in lat. 21° N. The Chinese bricklayers have, from time immemorial, used for chopping rice-straw to mix with lime, the very implement which has been patented in Britain within these ten years. The French have been peculiarly successful in preserving provisions by exclusion of air; but the Chinese had preceded them for centuries in their simple and effectual methods of keeping eggs, fish, and vegetables. China is the original country of silk in its greatest beauty; and it is only mentioned to relate an amiable sort of barbarity left, approaching to the hot-beds of Potsdam or Sevres, not so generally known. At Nankin, the emperor has a silk-

* Repertory, No. 5. † Printing Machine, No. 19.

manufactory worked by his own servants; their fabrics are finer than those of any other looms in China; none of the articles are sold, as they are made exclusively for the imperial family, or sent as presents to the emperor's high servants over the empire. The imperial manufacturers are said to have the privilege of taking (previous to their exposure to sale) the picked lots of silk in the district, and of selecting from a private loom any very ingenious weaver. Sugar is of early origin, and perhaps more is used in, and exported from, China, than all the rest of the world put together; and if their sugar-candy be taken into account, it does not yield to our highest refined sugar. The teas require not a word of encomium: it will be very long before the *sloe-leaf* gatherers on the hills of Brazil can rival them either in cheapness or quality.

THE STEAM-ENGINE, THE COTTON-SPINNERS' BEST FRIEND.

*From Mr. Tuffnell's Report to Central Board of Factory Commissioners.**

Of all the common prejudices that exist with respect to factory labour, there is none more unfounded than that which ascribes to its excessive tedium and irksomeness above other occupations, owing to its being carried on in conjunction with the "unceasing motion of the steam-engine." In an establishment for spinning or weaving cotton, all the hard work is performed by the steam-engine, which leaves for the attendant no manual labour at all, and literally nothing to do in general, but at intervals to perform some delicate operation, such as joining the threads that break, taking the cops off the spindles, &c. And it is so far from being true that the work in a factory is incessant, because the motion of a steam-engine is incessant, that the fact is, that the labour is not incessant on that very account, because it is performed in conjunction with the steam-engine. Of all manufacturing employments, those are by far the most irksome and incessant in which steam-engines are not employed; and the way to prevent an employment being incessant, is to introduce a steam-engine into it. And these remarks, strange as it may appear, apply peculiarly to the labour of children in cotton factories. Three-fourths of the children so employed are engaged in piecing at the mules, which, when they have receded a foot and a half, or two feet from the frame, leave nothing to be done,—not even attention is required either from spinner or piecer, but both stand idle for a time, which, if the spinning is fine, lasts, in general, three-fourths of a minute, or more. Consequently, in these establishments, if a child remains during twelve hours a day, for nine hours he performs no actual labour.† A spinner told me, that during these intervals he had read through several books. The scavengers, who have been said to be "constantly in a state of grief, always in terror, and every moment they have to spare stretched all their length upon the floor in a state of perspiration,"‡ I have seen idle for four minutes at a time, and certainly could not find that they ever dis-

* Quoted in the Mechanics' Magazine, No. 563.

† A piecer, however, generally attends two mules, whose motion is alternate, and then his leisure is six hours instead of nine.

‡ See Report of Factory Committee, page 325.

played any symptoms of the condition described in this extract from the Report of the Factory Committee.

If we wish to discover occupations which are really laborious, irksome, and incessant, we must go to those trades in which not only no steam-engine, but no machinery whatever, is used. The employment of milliners' girls is one of this description; they are engaged in it for a far longer period of time than the factory children; and I have it in evidence from medical gentlemen (*page* 120, *First Report*), that their health is more seriously affected by it than that of persons in factories. Surely bending over a needle sixteen hours a day cannot be deemed otherwise than laborious, irksome, and incessant in the highest degree. But the case of the pin-headers is the most glaring instance of the absurdity of the principle that sets a brand on those trades alone in which steam-engines are employed. The unhappy children engaged in this business, who are of a far tenderer age than any in factories (as I have seen them working at it before they have reached their sixth year), have to sit twelve hours daily at a table, with their bodies continually bent in the form of the letter C, their eyes intently fixed upon the pin-heads, and both hands and feet in perpetual motion.

At Derby there is a magnificent establishment for making bobbin-net, in which the whole of the machinery is moved by a steam-engine. The same machines are used at Nottingham, with the difference that they are there mostly worked by hand, and consequently the labour is infinitely heavier. In the Derby Factory the labour required is so slight and discontinuous, and the machine performs its work with such admirable precision, that many of the workmen were literally at sleep in their places when I visited the establishment; yet they are included in the Ten Hour Bill, while their Nottingham brethren are omitted. The master of the establishment complained of the serious loss he should sustain by the operation of the bill, and asked me what justice there was in subjecting his business to it, in which the labour of the workmen was evidently so light, while the hard-worked operatives in the factories of his Nottingham rivals were left untouched? I could not answer his question.

The most irksome employment connected with cotton-spinning, is "picking" cotton for fine work, an operation which is generally performed by the youngest children in the following way:—A fleece of cotton is hung up before the window, and the child standing constantly in the same place, with its head about six inches from the fleece, picks out the particles of dust that are lodged in it. The wearisomeness of this occupation must be, beyond all comparison, greater than that of the piecers or scavengers, as the child cannot stir from its place, but must keep perpetually looking at a bit of cotton; but it is not assisted by the steam-engine, consequently it may be worked twenty-four hours, or any number of hours, without intermission, for any thing Lord Ashley's Bill says to the contrary. In the coarse factories this work is done by the steam-engine, and therefore the child who attends the operation has not a tenth part of the labour to perform which it otherwise would have. Here, then, it is protected by a factory bill.

Occupations which are assisted by steam-engines require, for the most part, a higher species of labour than those which are not; the labour of the head is then partially substituted for the labour of the muscles; in fact, it becomes, in some measure, skilled labour, and, like all skilled labour, is paid highly, as the tables of wages I have given prove. In no other way can I account for the comparative high wages which factory

workmen, whether children or adults, obtain. "Batting" cotton seems by far the most laborious employment in a factory; it is performed entirely by women, without any assistance from the steam-engine, and is, at least, as hard as thrashing corn, to which it has a great similarity; yet those engaged at it do not earn, on an average, more than 6*s.* 6*d.* weekly, while, close by, may be seen women, and even children of fourteen, earning double and treble that sum at stretching, or power-loom weaving, in neither of which occupations is the labour one quarter as great. In power-loom weaving especially, the manual labour seems to be really nothing, as those who work at it frequently follow the motion of the lay by leaning on it with their arms, with the view of taking exercise; it is also the healthiest of mill occupations. Were factory work in every department seriously detrimental to health, this circumstance would account for the high rate at which it is paid; but the evidence proves so strongly that such is not the case, that we are compelled to resort to some other explanation.

Shall I be better believed, when I state that I myself, a short time ago, was impressed with the common prejudice respecting steam-engines; viz., that employment at them tended to degrade a man into a machine, and deaden all the powers of his mind? The minute attention I have been compelled to pay to this subject in discharging the duties of this commission, has convinced me that this is an idle and groundless notion, and, in fact, in most instances, it is the reverse of truth. Whatever employments have this degrading tendency, are among those in carrying on which no mechanical ingenuity has been applied: a workman of a superior class is always required to attend delicate or complicated machinery. Of course a child, nine years old, cannot be expected to display much skill in its work; but its education in factory labour must begin at that age, or it never can become a good skilled workman. Those who enter a mill at sixteen or seventeen always labour under great disadvantage, and earn comparatively little wages, from their inability to acquire that degree of tact and skill necessary to the due performance of factory work.

But the misrepresentations that have been put forth on the subject of the fine-spinning mills, are perhaps the most extraordinary of all; I have no hesitation in saying, that the labour in the fine-spinning mills of Manchester is lighter, pleasanter, and not less healthy than in any other mills in the town. The lightness of the labour is owing to the slowness with which the machinery moves in spinning fine numbers. The mule in spinning No. 30 or 40, makes, in general, three stretches a minute; in the high numbers only one, and sometimes less. This fact I have ascertained with the utmost precision, by frequently timing the motion of the machine, holding a watch that marked the moments in my hand. During at least three-fourths of this minute, the piecers, five of whom usually attend two mules, each containing 360 spindles, have literally nothing to do; they then stand listlessly by, their attention engaged by any thing but their work, till the mule recedes, when they instantly proceed to piece the threads which break, or are purposely broken (as in fine spinning, if a knot is perceived in any part of the yarn, it is intentionally broken). The piecing cannot take up long, as the mule has no sooner arrived at the frame than it instantly begins to advance; and when it has got about a foot and a half, or two feet from the frame, it is impossible to reach over to the rollers, and the period of idleness begins. There is far less work for the scavengers to do in fine spinning than in coarse, on account of the waste being so much smaller, and consequently this part of

the business is usually done by one of the piecers. Another superiority which these establishments have over the coarse-spinning factories, consists in the small quantity of dust that is evolved in every stage of the process; in fact, in the spinning-rooms there may be said to be no dust at all.

I was particularly struck with the portly appearance of many of the spinners in these establishments; and one of the fattest men I saw in Manchester, was spinning No. 180 in Mr. Houldsworth's factory, and he had been engaged in this work seventeen years. Another whom I questioned had been a fine-spinner for thirty-six years, and he was employed in spinning No. 200 at the moment I spoke to him. One of the most violent witnesses for the Ten Hour Bill that I examined (*Thomas Wilson, page* 65, *Second Report*), says that his health was much better when he worked in a fine-spinning mill than in a coarse. In short, the fine-spinning mills, which have been made the object of such deadly hostility, are, scientifically speaking, the glory of Manchester. Nothing can exceed the beauty, delicacy, and ingenuity of the machinery, the order in which it is kept, or the extraordinary results it is capable of producing. I have seen cotton spun in them of the number 350; in other words, a pound of cotton is stretched to the incredible length of 294,000 yards, or 167 miles, and is then sold for twenty-five guineas, the original cost of it having been 3*s.* 8*d.* It is the only part, too, of the cotton-trade in which England is absolutely unrivalled, as, with the exception of some attempts that have been made in France, no other nation can approach us in this department of manufacturing. The export of fine yarn is increasing more rapidly than of any other description of cotton goods. It is impossible to keep the coarse-spinning mills in the same order as the fine, owing to the greater dust occasioned by the work, and the machinery not being required of equal delicacy. They have, however, other peculiarities, which make them at least as worthy of attention. For instance, there is not unfrequently attached to them a department for power-looms, which are among the most extraordinary machines in a factory. I have stood by one of these looms, and minuted its operations with a watch, when I have seen it weave seventy-two square inches of cloth in a minute, without any human being attending to it. In factories thus furnished, the cotton enters in a raw state, and comes out as cloth; and of the numerous machines through which it has to pass, including the steam-engine which moves them all, there is not one that does not seem to demand the utmost stretch of human ingenuity to bring it to its present state,—not one that does not condense in its formation the result of at least a hundred patents, or that has not required in its invention the united efforts of at least a hundred minds.

GREAT BLAST AT CRAIGLEITH QUARRY.

THE long time in which preparations for a great explosion at this quarry had been going on, and the effects that were expected to result from the experiment, by a great saving of labour and expense, in at once dislodging a great mass of rock, and also lessening, if not altogether removing, the risk which attends the blowing up of small portions of rock from the flying fragments, rendered the experiment which took place on Saturday, the 18th of October, 1834, a subject of much interest both in a public

and scientific point of view. It having been intimated by bills that the blast was to take place at three o'clock, long before that hour crowds of people were proceeding along the roads leading to the quarry, and by three o'clock every place which commanded a view of the spot was filled with spectators. At the time when the explosion took place, there were no fewer than ten thousand persons on the grounds around the quarry; and curiosity was so much excited, that even on the Castle-hill, and also on the Corstorphine-hill, a great many people were collected. At half-past two o'clock, the conductor, inclosed in a block-tin tube twenty-six feet long and half-inch diameter, was introduced into the bore. The depth of the bore was sixty feet, and seven and a half inches diameter at top, and six at the bottom, and was charged with 500lbs. of Sir Henry Bridge's double-strong blasting-powder. At half-past three the match was lighted, and in three minutes the explosion took place. The report was not so loud as from a small piece of ordnance; but the effect that was produced was highly satisfactory to all the scientific gentlemen present, and completely fulfilled the expectations that had been conceived by the projector. At the moment of the explosion, the great mass of rock appeared to those at a short distance to be forced upwards, and then to rend in large and deep fissures. It is calculated that upwards of 20,000 tons of solid rock have been displaced by this experiment. The plan seems to be perfectly safe and practicable, and, we understand, was conducted and carried through by Mr. Millar, who, in 1824, after the great fire in the Parliament Close, suggested and carried into effect the blowing up of the gable of the high land which overlooked the Cowgate. Among the scientific gentlemen who were present, we observed Mr. Jardine, Mr. Playfair, Professor Wallace, Professor Forbes, Mr. Stevenson, Mr. Buchanan, and Mr. Grainger.*

PORTABLE HOT-WATER APPARATUS.

Mr. J. Major, a practical Correspondent of the *Gardener's Magazine*, has communicated to No. 48 of that useful journal, the following design of an apparatus, which he has employed with considerable success in warming entrance-halls and conservatories. Besides the portability of the apparatus, the aim of the inventer has been to avoid smoke and chimneys, which cannot usually be dispensed with, in the case of the introduction of coal or wood fires.

The apparatus may be made of tin or copper; the latter, though, of course, it would cost more at first, would, owing to its durability, in the end, no doubt, be the cheapest. Charcoal is employed for heating the apparatus; oil lamps have been tried instead of it, but with not near so good an effect. As it is neces-

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* Edinburgh Observer.

from this improvement is the security of the machinery from injury by shaking—a fruitful source of disorder and expense in all other locomotive steam-engines.

2nd. The cylinders are close to the boiler; so that the power of the steam is as great in them as in the boiler itself. In other carriages, the steam is conveyed to the cylinders through a pipe, by which its force is materially weakened.

3rd. The cylinders, which are placed vertically, instead of being long, and of comparatively small bore, causing a waste of time and power in the pistons making their strokes, are short and wide, being twelve inches diameter, and of the same length. The pistons make one hundred and sixty strokes per minute.

No pains or expense has been spared to render the whole machine as complete, convenient, and handsome as possible. Mr. Russell, the inventer, is distinguished as a mathematician, and is likewise a skilful machinist — two qualifications which, being combined, afford him many advantages over less accomplished competitors.

The fourth defect pointed out by the *Foreign Quarterly* in locomotive steam-engines, will not be soon or easily remedied. It is the want of some means of regulating the production or application of the steam power in proportion to the force required. At present, almost the *maximum* power of steam is produced, though it is not used or required except in overcoming extraordinary obstacles. For example, if the highest pressure required to propel the carriage up the steepest hill be sixty atmospheres, and the power for good level roads be forty, the difference is wasted, by that quantity of steam being let off; for the engine requires to have nearly the whole surplus power always at command in case of encountering an unexpected difficulty, as the steam power cannot be immediately raised on a sudden emergency, and there are no means of husbanding it. The consequence of this disadvantage is a great extra consumption of water and fuel.*

MOTION OF STEAM-VESSELS.

On May 29, a paper was read before the Royal Society, entitled, "An Investigation of the Laws which govern the Motion of Steam-Vessels, deduced from experiment." By P. W. Barlow, Esq., Civil Engineer.

The author commences with the description of a paddle-wheel for steam-vessels, of a new construction, in which the floats are made to enter and leave the water nearly in a vertical position. He then investigates several formulæ adapted to the calculation of the forces and velocities arising from this form of the apparatus; and gives an account of the results of various experiments made on its efficiency as compared with the common wheels,

* Spectator, Dec. 20.

and with relation to the consumption of fuel. The general results to which he is led are as follow :—1st. When vessels are so laden as that the wheel is but slightly immersed, little advantage is derived from the vertically acting paddles. 2ndly. In cases of deep immersion, the latter has considerable advantage over the wheel of the usual construction. 3rdly. In the common wheel, while the paddle passes through the lower portion of the arc, that is, when its position is vertical, it not only affords less resistance to the engine, but is less effective in propelling the vessel than in any part of its revolution. 4thly. The paddle of the wheel, while passing through the lower portion of the arc, affords more resistance to the engine, and is more effective in propelling the vessel, than in any part of its revolution; a property which is a serious deduction from its value; for in consequence of the total resistance to all the paddles being so much less than in the common wheel, much greater velocity is required to obtain the requisite pressure, and a greater expenditure of steam power is incurred. This loss of power is most sensible when the wheel is slightly immersed; but in cases of deep immersion, the vertical paddle has greatly the advantage. 5thly. In any wheel, the larger the paddles the less is the loss of force; because the velocity of the wheel is not required to exceed that of the vessel in so great a degree, in order to acquire the resistance necessary to propel the vessel. 6thly. With the same boat and the same wheel no advantage is gained by reducing the paddle so as to bring out the full power of the engine; the effect produced being simply that of increasing the speed of the wheel, and not that of the vessel. 7thly. An increase of speed will be obtained by reducing the diameter of the wheel; at least within such limits as allow of the floats remaining sufficiently immersed in the water; and provided the velocity of the engine does not exceed that at which it can perform its work properly. 8thly. An advantage would be gained by giving to the wheel a larger diameter, as far as the immersion of the paddles produced by loading the vessel would not so sensibly affect the angle of inclination of the paddle; but this advantage cannot be obtained with an engine of the same length of stroke, because, in order to allow the engine to make its full number of strokes, it will then be necessary to diminish the size of the paddles, which is a much greater evil than having a wheel of smaller diameter with larger paddles.

THE IRON STEAM-BOAT ALBURKHA.

In vessels constructed for warm climates, the superiority of iron to wood is plainly manifest. In these countries, the timber-work of the best-built ships is liable to destruction from rapid successions of extreme drought and heavy rains. Again, wood being a bad conductor of heat, and the hull of the vessel being of this

material, retains whatever heat is generated within the hold by steam-engines, or otherwise, or received from the intensity of the sun through the planks of the deck; which heat is not only injurious to health, but harbours vermin, as scorpions, centipedes, rats, and especially white ants, the destructive operations of

(The Alburkha Iron Steam-Boat.)

which must be well known to the reader. These evils are, however, prevented by the substitution of iron for wood; that metal conducting away the noxious heat, and rendering the temperature within the vessel no higher than the river in which she is sailing. The ravages of the ship-worm, which spares

neither the hardest and soundest oak or teak timber, are likewise defeated by the metal bottom, since, in salt water, it is soon covered with a strong coating of rust, impenetrable to these animals.

These results have been shown in iron steam-vessels on the Ganges;* and this success induced the company of Liverpool merchants, in fitting out the expedition under the late Mr. Richard Lander, to explore the Niger and the Quorra, to give a metal steam-boat a trial. The vessels, composing the expedition, consisted of two steamers and a brig. The largest of the steam-vessels was named the Quorra. "The second steam-vessel was formed of wrought iron; her draught of water was three hundred inches, and burden fifty-five tons. This vessel was named the Alburkha, signifying 'blessing,' and was intended to explore the small streams flowing into the Niger, and to proceed higher up the river than the Quorra could penetrate, in consequence of her draught of water. The brig Columbine accompanied the two steam-vessels, laden with articles of trade, provisions, and fuel, and was intended to proceed up the river as far as possible with them." †

The Alburkha was built at Liverpool by Messrs. M'Gregor, Laird, and Co. Her dimensions are—"Length, 70 feet; beam, 13 feet; depth, 6 feet 6 inches; tonnage, including engine-room, 56; draught of water, with engine, coals, and water in boiler, 2 feet 9 inches; with provisions, water, &c., for her voyage to the Niger, 4 feet 6 inches. The bottom and sides of this vessel are composed of iron plates, the former, five-sixteenths of an inch thick, the latter, a quarter of an inch: engine, fifteen horse power. All accounts that have been received from this vessel, agree in stating that she is much *cooler* and *drier*, and, of course, more healthy, than a vessel built of wood; that she is an excellent *sea* boat." ‡

A competent writer in the *Nautical Magazine* aptly observes, that "a new era in the annals of maritime enterprise will be dated from the departure of this exhibition, in the circumstance of a vessel constructed of iron first going to sea. An iron ship involves certain difficulties relating to the compass which are yet to be investigated; but, provided these be overcome, there appears to be no reason why iron should not be applied to the formation of ships. The subject is one of vast importance in many points of view, and there seems every appearance of

* The Lord William Bentinck iron steam-vessel, built by Messrs. Maudslay, was launched in July, 1832. This vessel is 125 feet long, with 22 feet beam, and when launched, her draught of water was eleven inches. She is one of a series to be constructed for the East India Company, destined for the navigation of the Ganges. The thickness of the iron varies from one-fourth to three-eighths of an inch.

† Nautical Magazine, vol i. p. 364.

‡ Nautical Magazine, vol. ii. p. 678.

success in the present experiment, as the Alburkha is found to be more buoyant and free from leakage, while, at the same time, she can be easily repaired, and is safer, in case of getting aground, than a vessel built of wood."

The Alburkha has been found completely to resist the effects of lightning, which falls harmless on it, though it is productive of mischief on other boats. "This," observes Mr. Murray, "results from the extreme conducting surface exposed to the meteor, and its consequent attenuation from its distribution and diffusion."*

The Quorra vessel, in the distance of the engraving, is about a hundred and forty-five tons burthen, and is propelled by an engine of fifty horse power. Her sides are fortified with eight six-pounders: in addition to which, she mounts a twenty-four-pound swivel gun forward, and an eighteen-pound carronade astern. She is also armed with additional protection outside to prevent her from being taken by surprise, and is well provided with small arms, &c. Her draught of water is not more than four feet, which, for river navigation, is a great advantage. She is schooner-rigged, and can remove her paddles, so as to economize her fuel, whenever it may be necessary.

For the original of the cut, our acknowledgments are due to the proprietors of the *Nautical Magazine*.†

REMOVAL OF GREAT WEIGHTS.

Is it not ridiculous that, in spite of our knowledge of the mechanical powers, nations in a semi-barbarous state should perform with ease and alacrity what our engineers fail to do? The famous gun Malik-e-meidan, or Lord of the Field, at Berjapoor, 14 feet 9 inches in length, with a bore of the diameter of 2 feet 5 inches, and 14 inches thickness of metal, was originally cast at Ahmednuggur, 150 miles from where it now lies, on one of the bastions of the wall of Berjapoor, yet the project of transporting it to England was, on account of its size and weight, given up in despair, as was also the case with the great gun at Agra, which has lately been blown to pieces. A large party of sailors and labourers were employed for a fortnight at Rangoon, in Birma, in transporting the large bell attached to the famous temple, a distance of a few yards to the river, in the middle of which they managed to deposit it, instead of in a brig as was intended. Despairing of success it was delivered over to the Birmese, who, in the course of *three days*, raised it from the bed of the river to its former situation in the temple.‡

* Mr. Murray's pamphlet on the Thunderstorm, wherein the Quorra instead of the Alburkha is stated to be the iron vessel.

† Abridged from the Mirror, No. 643.

‡ Mechanics' Magazine, No. 543.

ON THE DIRECT TENSILE STRENGTH OF CAST-IRON.

By E. Hodgkinson.

The absolute strength of this metal, notwithstanding the extensive use made of it in the arts, is still a matter of doubt. If we turn for information to authors, we find Mr. Tredgold and Dr. Robison making it nearly three times as great as Mr. Rennie or Captain Brown, and the advocate of the greater strength (Tredgold) attributing the less strength, as found by the others, to the straining force not having been kept in the centre of the prism. For supposing the extensions and compressions to continue always equal from equal forces (which they are under slight strains), a small deviation from a central strain would make a great reduction in the strength; and if the force were applied along the side of a square piece, the strength would be reduced to one-fourth (*Tredgold*, Art. 61, 62, 234.)

The above contrariety of opinion was the cause of the following experiments, in which the utmost care was taken to keep the straining force along the centre of the castings, which had their transverse section of the form +, except in the last two experiments, in which the section of the castings was rectangular, and the force applied exactly *along the side*. The iron was of a strong kind, the same as in the author's experiments on beams (*Manchester Memoirs*, vol. v.), and was broken by a machine on Captain Brown's principle for testing iron cables.

Force up the Middle.

Experiments.	Area of section in parts of an inch.	Breaking weight in tons.	Strength per square inch in tons.
1	3.012	22.5	7.47 } tons.
2	2.97	21.0	7.07 } mean 7.65.
3	3.031	25.5	8.41 }
4	2.95	19.5	6.59 Different quality of iron.

Force along the Side.

Experiments.	Area of section.	Breaking weight in tons.	Strength per inch.
5	4.83	11.5	2.38 } tons.
6	4.815	13.75	2.855 } mean 2.62

Whence the strength of a rectangular piece of cast-iron

drawn along the side is rather more than one-third of $7\frac{2}{3}$ tons, its strength, as above found, to bear a central strain (for $\frac{2.62}{7.65}$ $\frac{1}{3}$), but, from the preceding remarks, it ought only to be one-fourth; and, therefore, it would appear that a shifting of the neutral line had made the pieces capable of bearing a greater force along the side than in their natural state.*

BIRMINGHAM NEW TOWN HALL AND ORGAN.

This magnificent Hall is situated in Paradise-street, at the end of New-street, and towards the centre of the town of Birmingham.

The building is, in external length, 160 feet, including the arcaded basement in front, which projects over the causeway, to Paradise-street. "The height of the basement (which is rusticated), above the causeway, is 23 feet,—the columns resting upon its upper surface, or platform, are, with their entablature, 45 feet, and the pediment, forming the frontispiece, is 15 feet high, making a total height of 83 feet from the causeway to the acroterium. The columnar ordinance employed, is in imitation of the Roman foliated or Corinthian example of the temple of Jupiter Stator; the columns are fluted, and the entablature is generally enriched, though not to the full and elaborate extent of the original."

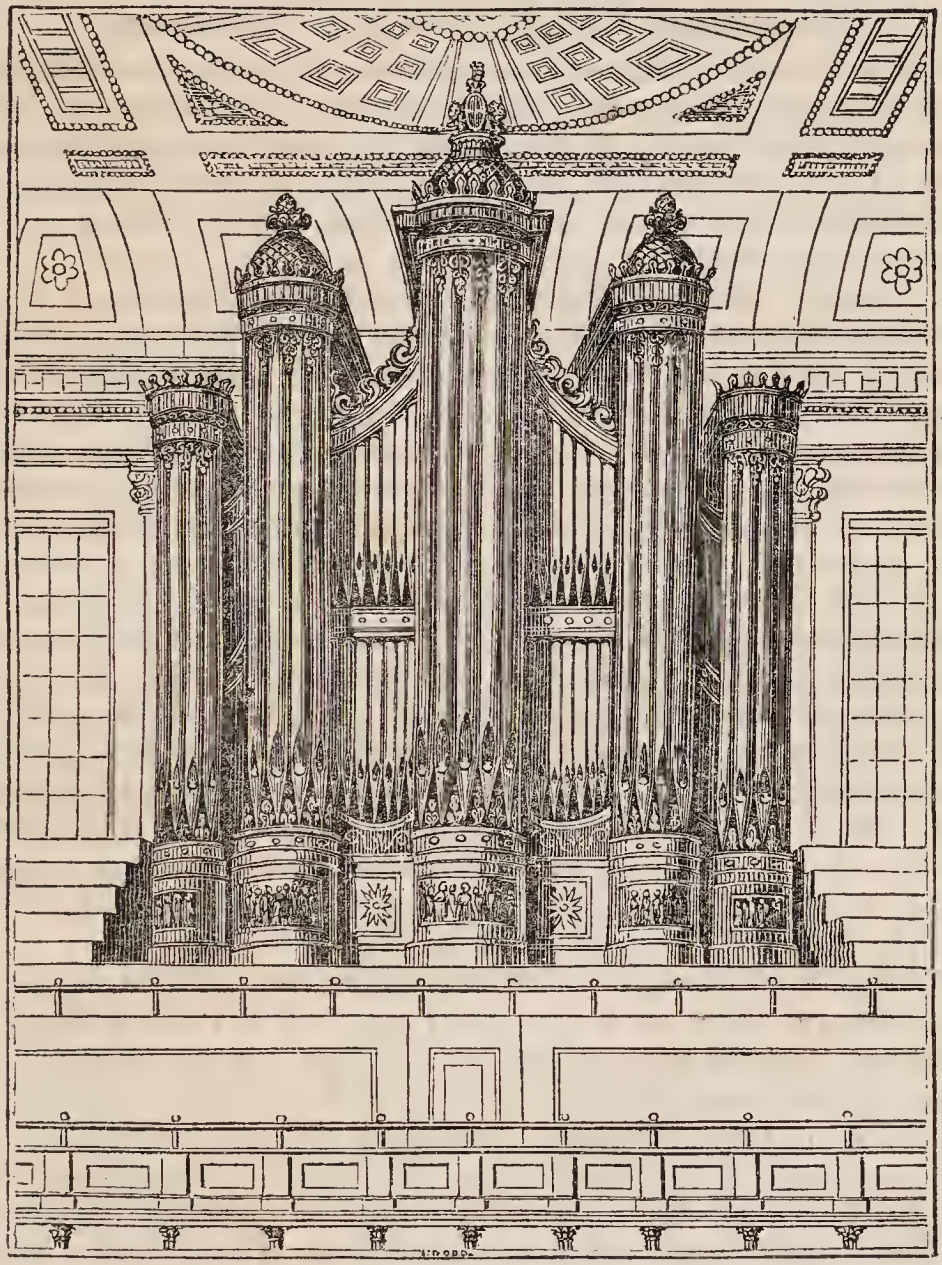
If the architecture of the New Hall remind us of the days of old Rome, the economy and ingenuity employed in its erection belong to no other times than our own. The structure is of bricks, which were made on the spot, of the earth excavated for the foundation. The walls are faced with Anglesea marble, of which material the columns and their accessories are also composed. The stones were cut and worked by machinery with steam power, and the columns were fluted by the same means; an invention, it is understood, of one of the contractors, and which far outstrips the patient chisels of the Jupiter Stator sculptors. "Another ingenious contrivance, consisting of a species of craning lever beam on rollers, was applied for the purpose of hoisting the framed tie-beams and principals of the roof from the ground up to the walls."†

The internal arrangement of this building exhibits a large saloon, or hall, 140 feet in length, 65 feet wide, clear of the walls, and 65 feet high from floor to ceiling; with corridors of communication running along on each side of it on its own level,

* Report of the Third Meeting of the British Association for the Advancement of Science.

† From "Public Improvements," in the *Companion to the Almanac*, 1834. In the *Mechanics' Magazine*, No. 554, it is stated that "an accident occurred in raising one of the principals, through the breaking of a hook, which caused the death of two individuals, over whose remains was erected a monument."

and staircases leading to upper corridors, to give access to galleries. The corridors are low, the two tiers being within the height of the basement externally. One end of the Hall is occupied by an organ, and surrounding orchestral arrangements; two narrow galleries run along the sides, and a large, deep gallery, occupies the other end; rooms for the accommodation of the performers who may be employed, are formed at the upper end of the building, and under the orchestra.



(The Organ in the Birmingham New Town Hall.)

The design for the Hall has been furnished by Mr. Harris, and the contracting builders are Messrs. Hanson and Welch, of Liverpool. The time given for the completion of the edifice was eighteen months, and the total cost is to be 18,000*l.*; though it is understood that the marble used in it is supplied by the pro-

prietor of the quarries free of cost, for the purpose of bringing the article into public repute.

The noble Hall is said to contain a larger quantity of cubic feet than any other in Europe, and will accommodate between 3 and 4,000 persons sitting, or 10,000 standing. Vast as are these dimensions, the spaciousness of the Hall is but proportionate to the stupendous size of the organ placed in it. This instrument is larger, in point of effect, than any other organ in the world, not excepting those of Haarlem and Rotterdam, and the superb instrument recently erected in York cathedral. But, when it is added, that the Birmingham organ is placed in one of the largest and best-proportioned rooms in Europe, without a column or impediment of any kind, to obstruct the proper circulation of the sound,—its situation may be considered as well calculated to display to advantage the full grandeur of this colossal instrument.

The organ occupies the space of a moderately-sized chapel, namely, 35 feet in width, 15 feet deep, and 45 feet high,—that is, a cubical space sufficient to contain, closely packed, 4,725 persons. The swell-box itself is, in dimensions, as large as an ordinarily sized church or chapel organ, being, in fact, equal to a moderately sized apartment. There are five bellows, occupying a space of nearly 400 superficial feet; there are four rows of keys, and about 60 stops; the principal pipe has a cubical area of 217 feet, which is sufficient to contain about 45 persons; the principal metal pipe is about 35 feet high, and about 20½ inches in diameter, being nearly half an inch larger than the largest metal pipe of the new organ in York cathedral. The weight of the foot of this pipe, which is not more than four feet in length, exceeds 224lbs., and supposing it to be of equal density throughout, the total weight is not far short of a ton. The timber alone required in the erection of this instrument will weigh between 20 and 30 tons, and the metal and other materials of the fabric will raise it to the total weight of, at least, 40 tons.

In this organ, there is a new and ingenious method of combining, upon one table of keys, the power of several parts of the instrument; the success of which will form an era in the history of organ-building. The greatest novelty, however, is the introduction of a peal of bells, placed in the swell-box, and, we believe, invented by Mr. Drury. The case of the instrument is from a design by Mr. Mackenzie, and is in perfect accordance with the architectural style of the building. The builder, and, in fact, the inventer of this vast instrument, is Mr. Hill, lately of the firm of Elliott and Hill, London.*

The organ has been built by subscription,† as funds for this

* From the *Birmingham Journal*, one of the oldest and best conducted provincial newspapers.

† The organ fund has received a handsome contribution from an unexpected source; for, at a late meeting of the subscribers to the fund,

purpose were not provided by the Act of Parliament, under which the Town Hall was erected.

MICROSCOPES.

At a late sitting of the Paris Academy of Sciences, a comparison was made of the merits of different microscopes lately invented. M. Selligues, first, in 1824, constructed a microscope with achromatic glasses. M. Amici sought to improve vastly upon Selligues, and, after much thought and labour, produced a microscope that was valued at 1,000 francs. "Lebaillif (we translate the lively reporter of the *National*), that scientific amateur, who was wont to gather around him all the observers and artists of Paris, possessed a variety of microscopes. He purchased the new one of M. Amici. The magnificent instrument was placed on the table. How it eclipsed all the other microscopes! beggarly things that cost 50 crowns, whilst it cost 40*l*. But great was the disappointment of the observers—the light was lost in the complexity of glasses, and many objects became utterly undiscernible in the new microscope. M. Lebaillif, immediately seizing a few glasses and a tube of pasteboard, improvised a microscope far superior to this most expensive complication. M. Trecourt caught the idea, ground the glasses himself, and produced the reduced achromatic microscope. This has two systems of eye-glasses; but its principal characteristic is its object-glass, consisting of three achromatized lenses. This triple mode is much preferable to the double of Selligues. This microscope costs 6*l*. sterling, with 1*l*. more for each magnifying system additional. By means of these, the microscope may magnify 2,250 times. But up to 1,000 times, the object remains admirably clear and perfect."*

HORSE-POWER FOR PROPELLING MACHINERY.

By Charles Keller.

A lever to which the horse is to be attached, is fixed to the vertical shaft of a cog-wheel, and the teeth of this take into an endless-screw, formed upon a horizontal shaft, which carries a band-wheel, or whirl, a strap from which may be extended to drive machinery. The cog-wheel, and the horizontal shaft which it drives, may be placed below the horse-walk, and the apparatus be thus confined to a small space, and rendered portable. The claim made is to "the application of the well-known principle of

raised in the year 1819, for the suppression of blasphemous and seditious publications, it was resolved to divide the sum remaining in hand, 1,036*l*., equally between the funds for the restoration of St. Peter's Church, and the completion of the organ in the Town Hall.

* Athenæum.

the endless-screw and cog-wheel to a portable horse-power for driving machinery."

The advantage which may be expected to result from this contrivance, is the obtaining the required speed by no further gearing than that described. The difficulty to be apprehended is the great friction to which the endless-screw must be subjected, which, if the materials are not extremely hard, and the rubbing parts are not constantly supplied with unguents, must soon wear it out.

The application of the endless-screw to a portable horse-power, is, we believe, new: it, however, has been used for driving boulters in flour-mills, and for other purposes. Mr. Nairne, the well-known philosophical instrument-maker of London, manufactured, about sixty years ago, many globe electrifying-machines, which were turned by a toothed-wheel, acting upon an endless-screw.*

AMERICAN PRESS FOR COTTON AND OTHER FIBROUS ARTICLES.

By Henry L. Conner.

This press is intended to operate upon two bales at the same time. The pressure is produced by causing an endless screw to revolve vertically. This screw is of considerable length, and is fixed in the centre of the frame-work of the press, so that horses, or other power, may be applied to the lever by which it is turned. A stout nut is adapted to the screw, and rises or falls as it revolves, serving, by means of jointed levers, operating upon the principle of the toggle joint, to act upon a follower. The follower is a long beam, the ends of which work in grooves in the cheeks of the press, which are at a sufficient distance, on each side from the screw, to act upon a bale of cotton, placed between it and the bed. The levers which act upon the bed are on each side of the nut, two in number, and they may be of equal length. They are connected with each other by a single joint; one of them also is united to the nut, and the other to the upper beam of the press in the same way. When the nut is down upon the follower, one of the levers lies upon it, and the other against the cheek of the press, consequently they are then at right angles with each other. To cause the jointed part to slide readily over one follower, friction-rollers are employed.

It is said, that with the power of the small horse thirty-four bales were pressed in a day, two at a time, so closely, that 530lbs. were contained within two feet square. Twelve bales a day is considered to be fair work with the ordinary double-screw press.

We apprehend that a large portion of the advantage derived

* Quoted from the Franklin Journal, in the Mechanics' Magazine, No. 561.

from this press, results from the toggle-joint action. At first, the cotton opposes scarcely any resistance, and the follower may then descend rapidly, which it will do by the action of the levers, whilst, at the period when the greatest power is wanted, their descent is proportionally slow.*

PAVED ROADS.

(From Sir Henry Parnell's Treatise on Roads.)

In situations where canals cannot be constructed, either from want of water, or other circumstances, and where the description and quantity of traffic, or local obstructions, do not justify the expense of forming a rail-road, paved roads made on proper principles would be found much better for conveying goods than turnpike roads, constructed as they usually are. The advantages which may be derived from paved roads, as a means of transport, have been too much overlooked; and, therefore, it is very important to show how much superior a well made paved road is to a common road, in enabling horses to draw very large burdens.

On a smooth, well made pavement, quite horizontal, it appears, from the experiments made with Mr. Macneill's machine, that the resistance to draught is not more than the 100th part of the weight of the carriage and its load, when the carriage is properly constructed, and mounted on straight and cylindrical axles.† According to this, a horse of great power would be able to draw on such a road, if horizontal, six tons and three quarters; and if with no greater inclination than 1 in 50, two tons and a quarter.

The plan of paving this road was altered in 1829: large blocks of granite, five or six feet in length, sixteen inches wide, and twelve inches deep, were laid for the wheels to run upon, as on a tram-road of iron, except that there is no flanche. The space between the granite blocks is paved. The plan has succeeded, as may be seen from the following report of Mr. Walker to the trustees of this road:—

"I beg to report the results of the experiments made this day upon the stone tramway now forming on the Commercial Road, before you, accompanied by the chairman of the West India Dock Company, and Mr. Colville, one of the directors.

"The experiments were made upon the space between the West India Dock-gate and the first turnpike upon the Commercial Road, with a very good town-made wagon, belonging to Messrs. Smith and Sons, distillers, and a stone truck, belonging to Messrs. Freeman.

"The dust had been swept off the tramway in the morning. The distance is 550 feet, of which 250 feet nearest the dock-gate rises 1 foot, or 1 in 250, and the other 300 feet rises about 2½ feet, or 1 in 116.

"The whole rise in the 500 feet is 3½ feet, or 1 in 155.

"The gravity of one ton upon the lower length is, therefore, 2,240lbs. divided by 250, or nearly 9lbs. Upon the upper length it is 2,240lbs. divided by 116, or 19½lbs., and the average of gravity upon the whole length is 2,240 divided by 155, or 14½lbs.

"Experiment 1st. The general average resistance of four tons gross (viz. wagon 1 ton 16 cwt., and goods 2 tons 4 cwt.), as ascertained by your

* Quoted from the Franklin Journal, in the Mechanics' Magazine, No. 561.

† See Seventh Report on the Holyhead Road.

chairman (C. H. Turner, Esq.) and Mr. Colville, by means of a spring weighing machine, was 127lbs.; from which, if we deduct the gravity of 4 tons, or 19½lbs. multiplied by 4, say 77lbs., there is left, for the friction of 4 tons, 50lbs., which gives for the friction of 1 ton 12½lbs., $\frac{1}{180}$th of the whole weight moved.

"This friction is not more than upon the best constructed edge railway. I consider that the greater size of our wheels, and there being no flanche, compensate for the roughness of the stones (from their being newly laid), as compared with an iron railway.

"Experiment 2nd. A pony, 12½ hands high, weight 4½ cwt., drew upon the upper part in our presence, and afterwards upon the lower part in your and the director's presence, six tons (gross). I was not aware that the difference of inclination of the two parts was so great, or he should have gone over the upper length again,—he had done it more than once before.

"Taking, therefore, the upper part on the rise of 1 in 116, the pony's exertion was,

	lbs.
"Gravity 19⅓lbs. multiplied by 6, or	116
Friction 12½lbs. multiplied by 6, or	75
Making together	191

and 191lbs. divided by 12½lbs. (the friction of one ton) gives 15 tons.

"The pony's work, therefore, was equal to *fifteen tons* drawn upon a level road.

"Experiment 3rd. The wagon, loaded as in the preceding experiment, being turned round and started by the pony's exertion, ran down the whole length to the dock-gate with increasing velocity (the pony not drawing it), and for a distance off the tramway, before it could be stopped: consequently the average fall of 1 in 155 exceeded the resistance by friction.

"Experiment 4th. A powerful horse (weight 14 cwt.) drew 12 tons gross (the wagon and truck loaded) from the West India Dock-gate to the turnpike, at the rate of four miles per hour.

"Taking, then, the upper length, or a rise of 1 in 116, we have,

	lbs.
Gravity 12 times 19⅓lbs., or	232
Friction 12 times 12½lbs., or	150
Making together	382

and 382lbs. divided by 12½lbs. gives 30½ tons.

"The horse's work was, therefore, the same as if he had been drawing 30½ tons upon the level.

"The full average work of a horse, per day, is 150lbs. moved 20 miles; consequently the pony was exerting one-fourth more than the average work of one horse through the day; and the horse was doing the work of 2½ horses.

"The horse appeared to go easily; but the exertion was, of course, too great to be continued for any considerable time, so as to form a basis for general calculation.

"Upon the whole, I think the conclusion is, that if the road were level, the work of a London draught horse upon the tramway would be ten tons (gross); but as the Commercial Road rises towards London, a

deduction must be made from this for gravity, the amount of which depends upon the inclination of the road, and is common to all kinds of roads and railways. Therefore, taking all things into consideration, I am of opinion that six tons (gross) from the Docks to Whitechapel, and a greater weight from Whitechapel to the Docks, may be considered a proper load for one horse on the tramway."

BURSTING OF STEAM-BOILERS.

On March 17, at the Paris Academy of Sciences, M. Seguier read a memoir on the precautions employed by M. Frimot, at Brest, against the bursting of steam-engines at high pressure. M. Frimot remarked, that explosions were occasioned rather by a sudden formation of steam, than by its progressive accumulation. The steam formed in his boiler, under a pressure of nine atmospheres, rose as high as twelve when an issue was given it. To obviate this, M. Frimot raised the level of the water in the boiler, which had the desired effect. This completely proved to him, that the instantaneous formation of steam was owing to the contact of the water, put in effervescence by the pressure, with the sides of the boiler. The level of the water being too low, exposed to the action of the flame part of the sides which the water did not touch, and these became heated to such a degree, as to vaporize in an instant a quantity of liquid, and thus augment the pressure suddenly. The possibility of producing the same effect by lowering the level of the water, indicates the mode of prevention, since it appears that explosion is imminent only when by any cause the water falls below the level which the constructor has established. Some mode, therefore, of giving warning of this lowering of the water, and of, at the same time, extinguishing the fire, was to be sought.—The first mode imagined by M. Frimot to arrive at these ends, was to place outside the boiler a metal tube, stopped at one of its extremities by a fusible stopper. This tube communicated with the boiler by two others,—one communicating with the upper part and the steam, the other joining the boiler a little below the level of the water. The latter is thus supplied with water from the boiler, and pours off its steam into the steam of the boiler also. But the supply of water to the tube ceases the moment that the water sinks below the general level in the boiler. The tube heats in consequence to a great degree, melts the fusible stopper, the steam escapes, and the danger is prevented. The escape of the steam warns the attendant by its sound, and he can turn the cocks: it moreover extinguishes the fire. The stopper is easily replaced, and the whole operation is over in three-quarters of an hour. But care should be taken to wash, from time to time, the fusible stopper, lest dirt or incrustation should prevent its fusion.

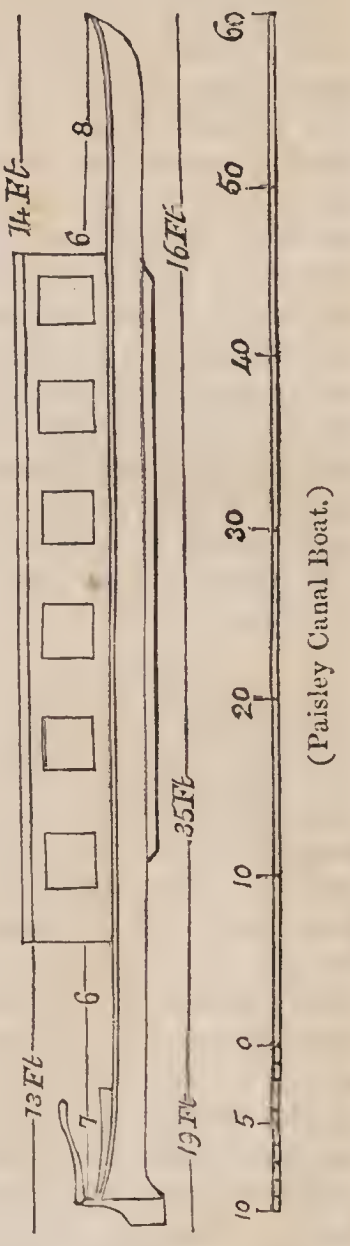
Another mode proposed by M. Frimot is a *manometre*, to measure the degree of tension. This he describes as a tube, twisted many times: each bend or twist is filled with mercury

below, and water above. The steam, exerting its action on the column of water in communication with the boiler, drives the mercury beneath into the next tube, and so on with the rest, sometimes entirely displacing the mercury. The sum of the weights of the mercury displaced, diminished by that of the columns of water, will indicate the degree of pressure of the steam.*

THE PAISLEY CANAL PASSAGE-BOATS.

Mr. James Whitelaw has communicated to the *Mechanics' Magazine*, No. 555, the following details of this successful improvement in canal navigation :—

Description of one of the Boats. — The length is 70 feet, width 6 feet, and 1 foot 10 inches in the depth. With ninety passengers, which is as many as a boat can conveniently take, the draught of water is 19¼ inches; when all the passengers are out, the draught is only 5½ inches. The rudder is 2 feet long and 20 inches deep, and its bottom is in a line with the under side of the keel. The weight of the iron-work is 17 cwt.; and the weight, when the boat is finished, is 33 cwt. The prefixed figure is a side view of one of the boats. The windows in front light the cabin, and those behind are for the steerage. The part at the bow marked 8 feet, is a deck for the passengers, and the part marked 6 feet has seats round it. The 6 feet towards the stern is for the same purpose as the 6 feet in front, and the 7 feet is a deck on which the steersman stands; under each deck is a place for any light luggage. The keel is 35 feet long, the part in front (under the boat) marked 16 feet, and that behind, marked 19 feet, have no keel; this allows the boat to turn quicker. A line stretched from the highest point in the bow to the highest point in the stern, would rise about 6 inches above the lowest part of the gunnel. The depth of the keel is 5 inches; and this depth did not form part of the measures given above, of the draught of water, and the depth of the boat. The plates are of 16th wire-gauge. The ribs are made of light gunnel-iron; and a rim of the same goes round the inside of the top edge of the boat, on which the wooden gunnel is fixed by means of square-headed screws. There are light ribs of wood laid inside of the boat on which the flooring is nailed, and a broad stripe of wood runs between the seats



(Paisley Canal Boat.)

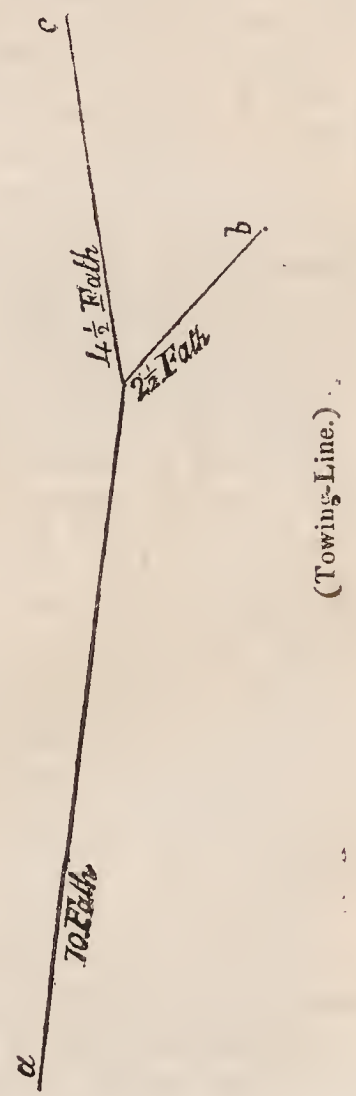
* Athenæum, No. 337.

and the windows, so high that the passengers may rest their backs upon it. The cotton oiled cloth which covers the cabin and steerage, requires three very thin coats of boiled oil to make it water-tight, and it should be dried in the sun if possible: very light curved ribs, set about two feet apart, support the cloth overhead, and it is fixed to the frames of the windows, &c., at the sides of the boat. A boat of this kind can be finished in a most comfortable style for 130*l.* The cost of the iron-work is 70*l.*, and 60*l.* will pay the joiner and other work of the boat.

The hooks (there is one on each side) on which the towing-line is fixed, are fastened to the gunnel of the boat at about 15 feet from the bow; the rope is put on one of these, when the boat is not very much loaded; but when there are a great many passengers, the rope is fixed about 3 feet 6 inches nearer the bow; this helps the boat round the turns on the canal. The shape of the hook is such as to prevent the rope, any time it slacks, from falling off.

As the Paisley canal is a very winding one, the longest towing-line that can be used on it is as follows:—

a, is the end connected to the boat; *b*, is fixed to the one horse, and *c*, to the other. If the rope were longer than this, it would draw the boat against the side, at a quick bend on the canal. The horse in front has blinders on it, and a boy rides on the one that is behind. The harness must be as light as possible. If the horses are run 12 miles a day, they keep in excellent order; but 16 miles per day is too much for them. The horses are changed every 4 miles. Half blood horses, or a breed between half blood and full blood, answer best.



The canal is 30 feet wide, except at the bridges, where it is only 11 feet; and there are two or three more contracted places on it, of considerable length. The average depth of the canal is 4 feet 6 inches. The sides of the canal are lined by a *perpendicular wall*, built of small stones, which goes 10 or 11 inches below the surface of the water, and as much above it. The distance from Glasgow to Paisley is 7¾ miles by the canal; and the distance from Glasgow to Johnstone is more than 11 miles. The boats run the distance between Glasgow and Paisley in 50 minutes, and take in and put out a good many passengers at different places on the way; and the distance from Paisley to Johnstone is run over in a time proportionably short. The cabin fare is 9*d.*, and the steerage fare is 6*d.*, from Glasgow to Paisley. When passengers go from Glasgow to Johnstone, they are charged 1*s.* in the cabin, and 9*d.* in the steerage.

The best speed for the Paisley canal boats is greater than 9 miles an hour; and this velocity occasions a very little

and gradual swell, not more than 7 inches high on the canal: there is no wave whatever at or before the bow of the boat, and the water is lower than the surface of the canal just behind the bow; it then begins to rise, and the wave reaches its maximum elevation at about two-thirds of the length of the boat from its bow; at the stern the elevation of the wave is nothing, and any ripple that follows the boat is occasioned by the action of the rudder to turn the boat. At the best velocity the horses have not a heavy pull; but when the boat is drawn so slow as 6 or 7 miles an hour, the strain on the towing-line is very great, and waves rise in front of the boat more than 18 inches high, and wash over the banks of the canal. On account of the boat's being so light, it may be brought from its maximum speed to a state of rest without raising a wave in front; and for the same reason it may be brought from a state of rest to its greatest speed before a very high wave has time to rise. At the bridges the wave at the side of the boat is rather more than 9 inches high when the boat is going at its best velocity; and when two of the boats pass each other at a quick rate, the wave is not worse than this. When two boats pass, the horses of one of them stop just before they come opposite the horses of the other boat, and a boatman takes the tow-line off its hook and holds it, in case it should come in contact with the bottom of the other boat, which is passing it at its full speed.

When the speed of the boat is low, the waves rise and get a great way a-head of it; if the velocity is increased to a certain extent, the boat keeps up to the wave; and if it sail quicker still, the bow gets before the swell, which decreases in height as the velocity of the boat increases —in the highest velocities, at least, that Mr. Whitelaw has seen the boat brought up to. From this it would appear that the wave has a determinate velocity, like the undulations that cause sound; at any rate, it has a maximum velocity; and if the whole cause of the formation of the wave continues when the boat goes quicker than its motion, the wave will fall behind. Now there is a vacuum formed towards the stern of every vessel when it is sailing; this, together with the height at which the waves stand above the level of the canal, and the motion of the wave in the direction of the boat, will cause it (the wave) to fall in towards the stern of the vessel, and act on its inclined sides, giving back a great part of the power spent in its formation, if the vessel is properly formed. The water sent towards the sides of the canal by the inclination of the bow, will be reflected from the perpendicular facing on the banks, and act in the same way. The *lateral communication of motion* among particles going in different directions, may have a tendency to keep down the swell. If this explanation be correct, the boats must have their dimensions and form corresponding to the width of the canal, and the velocity they are to sail at.

As the boat *rises* on the wave, its bow is up or down, according as the wave is fore or aft.

AMERICAN RAILWAYS.

THE country, which surpasses all others in the spirit and rapidity by which its means of inland transport have been improved, is the United States. The number and extent of rail-roads completed, in progress, or projected throughout the union, must surprise all who have not attended to the advances made by this

country in the arts of life. We extract from a tabular view, published under the direction of Congress in 1833, the following list of rail-roads then executed and projected in different States:—

	Completed.	Projected.
Massachusetts	5	4
Rhode Island	—	2
New York	6	25
New Jersey	5	1
Pennsylvania	15	67
Delaware	2	—
Maryland	2	2
Virginia	2	5
North Carolina	3	3
South Carolina	1	—
Georgia	1	2
Alabama	2	1
Mississippi	—	2
Louisiana	1	1
Kentucky	1	—
Ohio	—	12
Indiana	—	8
Illinios	—	1
D. of Colombia	—	1
Total	46	137

From the above statement, it will be seen that the State of Pennsylvania takes the lead in the construction of inland communications. The earliest and most extensive rail-road constructed in this State was undertaken by the government, and forms a continuation of the Union canal; stretching from the eastern to the western extremity of the State, and connecting the city of Philadelphia with the banks of the Alleghany and the Ohio. This great line of communication consists of three divisions; the first extending from Philadelphia to Columbia, which consists of a rail-road constructed in a manner nearly similar to, and in some respects with a greater degree of stability, than the Liverpool and Manchester road. Nearly the whole of it is formed of what is called the edge rail or rolled iron, similar to that used on the Wigan road; the weight of iron being 41¼lbs. per yard, which is 6¼lbs. more than the weight of the Manchester rails. The line is conducted very nearly level; the slopes being such that the effect of the power of traction upon the line is 71 per cent. of what it would be on a dead level of equal length. The road is conducted over several rivers, which it intersects nearly at right angles; the valleys, where embankments could not conveniently be constructed, are crossed by 31 viaducts, the aggregate length of which is about a mile and a half. There are 73 stone culverts, from 3 to 25 feet span; 500 stone drains, 2 feet wide, and 3 feet high; 18 road and farm bridges, 8 of which have stone arches of 25 feet span, and the remainder stone abutments, with wooden

superstructures of 31 to 54 feet span. The excavations are frequently deep, and the embankments lofty; in one place the road is elevated 80 perpendicular feet above the bottom of the ravine, and, in other places, cuttings of 40 feet deep occur.

From the extremity of this road at Columbia to Hollidaysburg, on the Juniata, extends the Union canal, by which the communication is continued. From Hollidaysburg to Johnstown, on the Conemaugh river, the rail-road is resumed for a distance of 36 and a half miles. This line of road crosses the Alleghany monntains by a series of slopes, and by a tunnel 900 feet long, 19 feet high, and 22 feet wide. There are 400 askew viaducts, besides 72 culverts and other structures of masonry; the rails are similar to those on the Manchester railway, but are 4½lbs. heavier, weighing 39½lbs. per yard: the rails are constructed upon stone sleepers in the same manner as on the Manchester line, except on embankments, where wooden string pieces are used.

The little Schuylkill rail-road extends from Port Clinton to the town of Tamaqua, a distance of about 23 miles. It is formed, like many other rail-roads in the States intended for light traffic, of wooden rails, shod with iron bars. Although the chief design was the transport of coals, it has been executed with a view to general trade, and stage-coaches, worked by horses, already ply on it.

One of the most important of the Pennsylvania rail-roads, is that which extends from Carbondale to Honesdale, connecting the whole country, watered by the great branch of the Susquehanna, with the Hudson, and by that river with the city of New York. A canal commences on the Roundont, near its junction with the Hudson, and terminates at Honesdale, 106 miles from the town of Eddyville, on the Roundont, and 90 miles from New York. The rail-road continues the line from thence to the coal mines near Carbondale, on the Lackawanna. An act, authorizing a rail-road from the Lackawanna to the Susquehanna, has passed the legislature of Pennsylvania; and if that line be executed, an immense amount of merchandise will be conveyed along the Carbondale and Honesdale line.

The rail-roads of Pennsylvania are chiefly constructed in those districts which produce anthracite and bituminous coal. The greater number of these being adapted for low velocities, and light transport, are formed of wooden string pieces, which are sometimes shod with iron bar. In many cases the road follows the natural surface of the ground, and their construction is, therefore, attended with but small expense, especially in a country where the expense even of the best timber scarcely exceeds the labour of cutting it.

Another important rail-road is that by which the cities of Philadelphia and New York are connected. This road commences at Camden, a town on the bank of the Delaware, opposite Philadelphia, and from thence it is carried nearly in a straight

line to Amboy, at the mouth of the Hudson. The length of this road is about 60 miles; the rails are of rolled iron, similar to our best rail-roads, and 4¼lbs. heavier than the Manchester rails, being 39¼lbs. per yard: they are attached to stone sleepers, by pins at the sides, without chairs.

The Newcastle and Frenchtown rail-road connects the Delaware with the Chesapeake, and forms the great line of communication between Philadelphia and Baltimore. This road is formed of wooden rails, shod with iron bars; the former are of Georgian pitch pine, 6 inches square in the section, and the latter 2¼ inches wide, and five-eighths of an inch thick, attached to the timber by iron nails. The entire length of this line is 16 miles.

A line of road, one part of which is called the Hudson and Mohawk, and the other the Schenectady and Saratoga rail-road, continues the line of transport from New York by the Hudson, in a direction northward from Albany. A prodigious intercourse by steam-boats takes place between New York and Albany, on the Hudson. The line of rail-road from Albany to Schenectady, a distance of 16 miles, has been constructed to connect this line of communication with the grand canal at Schenectady, by which it is carried from thence in a westward direction, a distance of about 250 miles, to the town of Buffalo, on Lake Erie. From Schenectady, the second branch of the rail-road continues the line of communication in a northern direction, a distance of about 20 miles, to the shores of Lake George; from which, by Lake Champlain, there is a continuous water communication with the river St. Lawrence.

One of the most magnificent American rail-road projects, is that which has been entitled the Baltimore and Ohio rail-road. This splendid line of communication will commence at the city of Baltimore, and cross the State of Maryland in a westerly direction, passing south of Fredericktown and the city of Washington, to each of which branches have been constructed. It will thence proceed to some point on the Ohio river, between Pittsburg and the mouth of the little Kennoway river.

The whole length of the road, from Baltimore to Pittsburg, will be about 330 miles. The most difficult and expensive portion of this rail-road has, we believe, been already completed: it extends from Baltimore to a place on the Potomac river called the Point of Rocks, a distance of 70 miles. It consists of a double track; and it appears that, on the 1st of December, 1831, the communication was opened between Baltimore and the city of Frederick, and has been continued without interruption since that time. The communication between the Point of Rocks and Baltimore commenced on the 1st of April, 1832. The directors state, in their seventh report, dated in October, 1833, that they are justified in assuring the stockholders of their entire confidence in the final success of the work; that the practicability of applying steam power upon it had been satisfactorily ascertained;

and that new sources of revenue, not contemplated by the original projectors, had been developed, by the opening of adjacent quarries, and the felling of forests, the products of which have become objects of transport upon the rail-road. They had entered into a compromise with the Chesapeake and Ohio Canal Company, to carry the railway along the bank of that canal, to a place called Harper's Ferry ; which distance, it was calculated, would be completed by the 1st of January, 1835. This section of the road, communicating with the Winchester and Potomac rail-road, which likewise terminates at Harper's Ferry, opens a continued rail-road communication between Baltimore and the rich valley of Virginia. The thriving and enterprising town of Winchester would thus be likewise connected with Baltimore ; nor would it be too much to anticipate that the line of communication would be continued by Stanton, in a south-westerly direction, to the cotton districts of Tennessee ; finding its way to the tributaries of the Ohio, and connecting, by a grand line of communication, the waters of the Atlantic with those which empty themselves through the Mississippi into the Gulf of Mexico.

In the autumn of 1830 was commenced a line of rail-road, extending from Baltimore to the town of York, in Pennsylvania, a distance of 70 miles. This road is formed of wooden string pieces, shod with iron rails, two inches broad, and half an inch thick.

In 1831 was commenced a line of rail-road to connect the northern and southern states, commencing at Petersburg, in Virginia, and terminating at Wolden, on the Roanoke. The structure is similar to that of the last-mentioned line.

The South Carolina rail-road was commenced in the autumn of 1830, and nearly 100 miles of the line were completed in 1833. The road extends from the city of Charleston to the town of Hamburg, situate on the Savannah, opposite to Augusta. This is a single line of road 135¼ miles in length. The plan is nearly straight, and the undulations extremely gentle ; no slope exceeding 30 feet in a mile, with the exception of one inclined plane, which is worked by a stationary engine. The rails are flat iron bars, attached to strong wooden beams. These beams are supported throughout almost the whole length of the road on piles driven into the ground, secured also by strong ties. In some of the marshes which are crossed by the road, these piles are driven to a great depth. On this road there are but few embankments ; the valleys being almost invariably crossed by viaducts supported by piles and carpentry. In fact, the railway is described as resembling a continuous bridge. Locomotive-engines have been for some time worked on this road. It is intended that this great line of communication shall be continued from Augusta to the Tennessee river, a distance of about 230 miles.*

* Edinburgh Review.

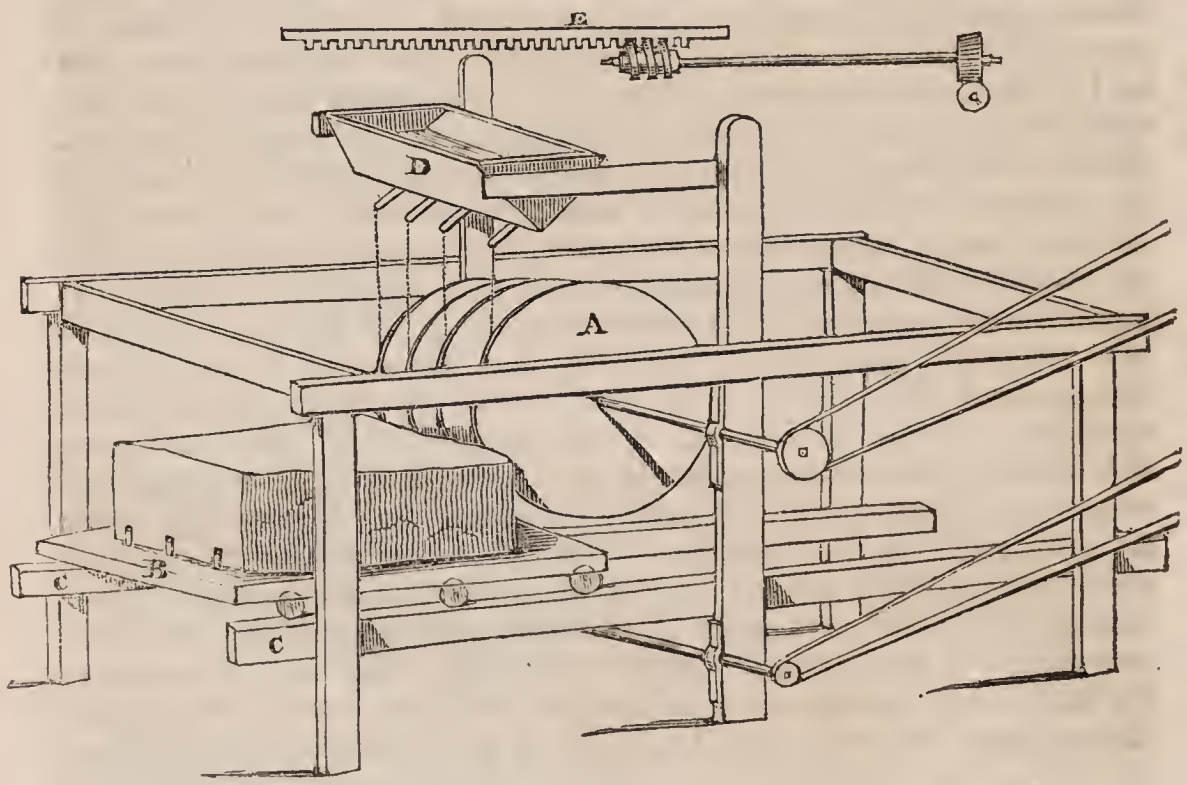
MACHINE FOR CUTTING MARBLE.

Mr. George Washington Wildes, of Coleman-street, has patented the following Improvements in Machinery for cutting Marble and other Stone, and cutting or forming Mouldings or Groovings thereon.

The sawing is performed by means of improved revolving circular metallic plates, smooth, or without teeth, upon the face or edge, operating by friction with sand and water, upon the material to be cut; and the moulding, or grooving, and polishing, is effected by means of the improved revolving moulding and polishing cylinder, or wheel, operating in cutting mouldings by friction with sand and water, upon the surface to be wrought; and polishing by friction, in like manner, with putty, buff, pummice stone, or some other suitable material; videlicit, one or more circular metallic plates, smooth, or not serrated upon the face or cutting edge (copper or soft iron are deemed preferable) are securely fixed upon a horizontal shaft or spindle of iron of any required dimensions passing through the centre of the plate or plates, and supported at each end by a proper frame of wood, or of cast-iron, upon which the shaft works. On one end of the shaft is a cog-wheel to connect it to the moving power, or a pulley and band; the last has been found to answer best practically. Where two or more plates are used on the same shaft, they are secured at the proper distance from and parallel to each other, by circular metallic bands or washers, of a thickness adapted to the intended thickness of the slab or slabs to be cut; which bands are fitted upon and around the shaft, between the plates or saws. Under the shaft, at the distance of a little more than the radius of the plates or saws, is a carriage on friction-rollers or wheels, resting on a permanent railway, to support and carry forward the stone or marble to the plates or saws: it is moved either by a rack and pinion, or by weights and pulleys. Over the saws is fixed a hopper, filled with sand and water, which is carried by a conductor leading from an aperture in its bottom, to the saws at the point of their contact with the stone or marble. The plates or saws may be made of any required dimensions, and must be wrought to a uniform thickness throughout, with the cutting-edge smooth, or not serrated, and either rounded bevelled, or flat. They are securely fixed upon the shaft, and subsequently turned in a lathe, to make them run with the greatest possible accuracy. The proper speed varies, according to the diameter, from about three hundred revolutions per minute for a saw of two feet diameter, down to one hundred and fifty revolutions per minute for a saw of four feet diameter.

The improved moulding and polishing cylinder, or wheel, is of any metal (cast-iron is preferable for moulding, and some of the softer metals, and wood, for polishing), and of any requisite dimensions, having the converse of the intended moulding, or

grooving, either cast or turned upon its surface or periphery, by means of which any series of mouldings or groovings can be wrought on a surface of marble or stone at one operation, and in like manner be polished. It is fixed upon a horizontal shaft passing through its axis, which is turned by a cog-wheel, or pulley and band, connecting it to the power, and operates on the material to be wrought, by revolving vertically against its surface in contact with sand and water, in cutting mouldings, and in contact with pummice stone, buff, or some other suitable material in polishing. The speed of the moulding-wheels may be greater than that of the saws nearly two-fold, and the polishing-wheels may be run at a higher speed than the moulding-wheels. A cylinder, having a regular smooth surface, is used in like manner for flatting, and for polishing a plain surface. The marble, or stone, is carried forward, and under the moulding and polishing cylinder, by a mechanical arrangement similar to that before described.



(Wildes' Patent Machine for Cutting Marble.)

Description of the Cut.—A, the saws, or the moulding-cylinder, of cast-iron. B, the carriage to support and carry forward the marble or stone. C, C, the rails on which the carriage travels. D, the hopper, for sand and water; and E, the apparatus for advancing the carriage. The polishing cylinder is similar in form to the above, and used in like manner with polishing-powder, as putty, buff, &c., instead of sand, and is made of wood, or some of the softer metals.

The improvements claimed consist in the sawing of marble or other stone, by means of a revolving circular metallic plate,

smooth, or not serrated, on the face or edge, and applied with sand and water, as is done with the straight saw; and also in making or forming upon surface or periphery of a metallic or wooden cylinder or wheel, the converse of the intended moulding or grooving, by means of which a series of mouldings or grooves can be wrought on a surface of marble or stone, at one operation, with sand and water; and, in like manner, polished with putty, buff, pummice stone, or other polishing material.*

NEW MOORING.

On March 18, at the Institution of Civil Engineers, Mr. Mitchel† produced a model of his new mooring, which is on the principle of the screw, the spiral thread being extended to a broad flange, with little more than one revolution round the central shaft. It is inserted by means of a long shaft, adapted by joints to the proper depth; when a firm hold is obtained, the shaft is withdrawn, leaving the mooring, with a strong bridle chain attached. Some of these moorings have been placed twenty feet below the bed of a river: the flanges have been used from two to five feet in diameter; but, if necessary, may be used larger. Two moorings of this description have been driven in the river Medway, at the depths of thirteen and a half, and fourteen feet, to which ships of large burden have been attached; and, notwithstanding the storms which prevailed at the time, the moorings remain uninjured: the expense of construction is much in favour of this new mooring; one driven in thirty feet of water, ten feet into the ground, cost 500*l.*, while one of the old construction, in a similar situation, would have cost 2,800*l.* Mr. Mitchell considered that his invention might also be advantageously applied in piling, being equally capable of resisting a force downwards as upwards. A member had proved the efficiency of screws similarly applied: having occasion to erect a scaffolding in the current of the Thames, near Rotherhithe, he made use of cast-iron screws, four feet long, to which were attached cast-iron bases, for the poles to rest on: so firmly were the screws imbedded, that an immense force was requisite to extract them.*

EXPENSE OF RAILWAYS.

(*From Sir Henry Parnell's Treatise on Roads.*)

The expense of constructing railways, depends upon the nature of the ground they are made over, and the purpose for which they are intended. In many situations, where the trade is altogether a descending one, and water scarce, they are preferable to canals, and may be constructed cheaper; but for general traffic over a wide extent of country, they do not afford as cheap a means of conveyance as canals.

* Repertory of Patent Inventions, No. 10.
† Athenæum, No. 342.

In some instances, railways have been constructed for 1,000*l.* per mile, but in others, the Manchester and Liverpool, for instance, the expense per mile has exceeded 30,000*l.*

It is stated in the Quarterly Review, No. lxii. p. 363, that the general average of a number of rail-roads, some tram-rails, others edge-rails, some of cast-iron, others of wrought-iron, of upwards of 500 miles extent, is, as nearly as possible, 4,000*l.* per mile, allowing them a double set of tracks; and the writer very justly remarks, "From the imperfections of these old rail-roads, we may extend the average to 5,000*l.* per mile." Mr. Tredgold estimates the annual repair of a rail-road at 557*l.* per mile.

Mr. Stephenson estimated the cost of making a rail-road from London to Birmingham, at 2,500,000*l.*, or 21,756*l.* per mile; but other engineers have calculated the total expense at about 3,500,000*l.*, or at 30,400*l.* per mile.

The annual expense of keeping a rail-road in repair, depends upon the velocity with which the wagons are drawn over it. Mr. Walker, in his Report to the Directors of the Manchester and Liverpool Rail-road, states, "that, as the speed with engines is greater than with horses, the injury is greater in case of any irregularity."

It has been well ascertained, that rail-roads on which horses are employed, are always found in much better order and repair than those on which locomotive engines are used.

The relative expense of transporting goods upon canals, railways, and common roads, may be estimated as follows:—From various observations which have been made on the work actually performed by horses on several railways, it may be assumed, that the greatest effect produced by horses is twelve tons gross, drawn over a space of twenty miles per day; and, as the wagons employed on railways are generally one-third of the gross weight, the net weight of the goods carried will be eight tons over twenty miles per day, by one horse, or 160 tons over one mile, at the average velocity of two miles per hour. The expense may be taken at two-pence per ton per mile.

On canals, one horse will draw a boat containing twenty-five tons of goods over a space of sixteen miles per day, at the speed of two miles and a half per hour: this is equivalent to $25+16=400$ tons of merchandise carried over one mile per day, or two and a half times as much as on a railway. The actual expense of transporting goods by canal, is only one halfpenny per ton per mile, including boat-hire, steersman, wages, and horse-power.

In Scotland and Ireland, where the roads are made with broken stones, and where the practice is to use one-horse carts, the work which horses perform may be taken at 25 cwt., exclusive of the cart. But in England, where wagons are used, and the roads are not so hard, the work of horses may be taken at 15 cwt. In the latter case, the average cost is about nine-pence per ton per mile, including the wear and tear of the carts, and the wages of the drivers. In some parts of the country, the cost is sixpence per mile, but in other parts, as near London, it is one shilling.

BABBAGE'S CALCULATING MACHINERY.

On May 2, Dr. Lardner delivered, at the Royal Institution, a lecture on Babbage's Calculating Machinery; his object being, not so much to describe the details of the mechanism of the cal-

culating machinery, as to demonstrate the absolute necessity of this, or some other equally perfect means, of producing a sufficient number of printed copies of a vast variety of numerical tables used in science, commerce, and the useful arts, each individual copy possessing absolute and infallible numerical accuracy, and to produce these at such a moderate expense of labour and money, as would be compatible with due economy. A considerable portion of the lecture was, therefore, devoted to an exposition of the variety and number of the tables which are absolutely necessary for the purposes of astronomy and navigation. It was obvious that such an enumeration must needs be extremely imperfect, inasmuch as to express even the titles of a tenth part of the necessary tables, would occupy more than the entire time devoted to this lecture. A few were, therefore, selected from some of the principal classes.

A great variety of multiplication tables were mentioned, extending, in some cases, as far as 1,000 times 1,000: these were computed and printed at enormous expense and labour by the English Board of Longitude, the French Board of Longitude, and by the Prussian Government. Analogous to these, were likewise tables of the powers of numbers, to compute which, the late Dr. Hutton and Professor Barlow were employed by the Board of Longitude. A variety of other purely arithmetical tables were glanced at, which were calculated and printed by Barlow and others. Next followed the pure trigonometrical tables of sines, co-sines, tangents, secants, &c. &c. &c., printed, published, and computed, at inconceivable expense and labour, by almost every civilized nation of the world, from Great Britain to China. The invention of logarithms, supplying a new and abridged method of calculation, at once doubled the number of tables, by making it necessary to compute tables of the logarithms of all those numbers which had been previously tabulated. Independently of these were a myriad of other tables, in which it became necessary to exhibit the logarithms of numbers combined by various arithmetical relations, such as sums, differences, &c.: tables of the powers of trigonometrical quantities, of triangular and polygonal numbers, of trigonometrical quantities expressed in terms of the radius, of arcs in terms of the radius, of hyperbolic sines, co-sines, &c., of hyperbolic logarithms, &c. This enumeration, extensive and varied as it is, comprises only tables of a general and mathematical nature, the extent and variety of which, and the difficulties of their computation, are trifling compared with the tables specially related to particular sciences and arts. The lecturer merely glanced at tables of interest, discount, rates, annuities, tables connected with insurances generally, tables of linear, superficial, and cubic measure, tables connected with meteorology, a cloud of tables exclusively useful in the astronomical observatory, and passed to the consideration of those tables immediately or remotely

necessary to determine the place of a ship at sea. After explaining the methods of determining the latitude and longitude, and showing the necessary dependence of such methods on the apparent places of the sun, moon, principal planets, and conspicuous zodiacal stars, some of the tables necessary for the determination of those places were mentioned, such as tables of the sun and moon from hour to hour, of lunar distances for every third hour, the tables called *requisite tables*, the tables necessary to determine the places of 100 zodiacal stars. It was next shown that, even were it possible to obtain such tables correct at any one epoch, they would require constant re-computation, owing to improvements in astronomical science, by which more correct values of their elements, or arguments, are constantly being found. As examples of this, it was stated that within six years it was necessary to compute the tables of the sun three times; that the tables of the moon computed for the Board of Longitude in 1770, at an expense of nearly 4,000*l.*, were speedily rendered useless, and, after the lapse of a long period, were replaced by Bury's celebrated tables in 1806; and even these did not outlive six years, when they were themselves superseded by the tables of Buckhardt; and recently these again have yielded to the more accurate tables computed from elements furnished by Damoseau. Another example was produced in the tables of the principal planets, computed in 1808 by Bouvard, which were rendered useless in a dozen years by the imperfect knowledge of the solar system; and a new set of tables were computed by the same astronomer. Even admitting for a moment the possibility of obtainining all these tables accurately printed (a result which Dr. L. would presently prove to be utterly impracticable), still they would be insufficient for the purposes of modern navigation. The places of the sun and moon, and the latter especially, should be computed for shorter intervals, and the places of many more zodiacal stars should be determined—100 only were given in the present Nautical Almanac, although there are more than ten times that number, the occultations of which, by the moon, can be distinctly observed from a vessel at sea. To determine the place of each star would require ten tables; so that this object alone, setting aside all others, would require more than 10,000 numerical tables, the production of which, by any other method than some such as that proposed by Mr. Babbage, would be utterly impossible. The lecturer next proceeded to furnish proofs of the extensive errors by which all existing tables were at present vitiated, and observed, that from the chances against an error being detected, it might reasonably be assumed, that for every error actually detected, a multitude of undetected ones must exist. In a single page of one set of nautical tables, he showed about fifty errors: in other sets of tables, a single individual had detected in some five hundred, and in others one thousand errors. These errors

proved a prolific source of others, partly from the circumstance of some tables being more or less copied from others, and partly because one computed table is often used as the data from which another, of a different kind, may be derived. Under the latter circumstances, a single error in one table may vitiate nearly the whole of another. Remarkable examples were given of the same errors prevailing through not less than twenty different tables published in different parts of the world. Next ensued a general view of the principle of the calculating machinery, and of the method by which it calculates and prints. This, however, for the reasons above stated, was necessarily a description of a very general nature. Those who were curious to learn further details respecting it, were referred to Dr. Lardner's lectures devoted exclusively to it. He stated, that the principle on which the machine was founded, was one of a perfectly general nature, and that the machine was, therefore, applicable to numerical tables of every kind, and that it was capable not only of computing and printing, with perfect accuracy, an unlimited number of copies of every numerical table which has ever been hitherto wanted, but also it is demonstrable that it is capable of printing every table which can ever be required hereafter. It appears that the front elevation of the calculating machinery will present seven upright columns, each consisting of eighteen cages of wheel-work, the mechanism in each cage being identically the same, and consisting of two parts, one capable of transmitting addition from the left to the right, and the other capable of transmitting the process of carrying upwards; for it appears that all calculations are, by this machinery, reduced to the process of addition. There will, therefore, be one hundred and thirty-six repetitions of the same train of wheel-work, each acting upon the other, and the process of addition with which the pen would be going on successively from figure to figure, will here be performed simultaneously, and, as the mechanism cannot err, with unfailing accuracy. The results of this calculating mechanism are transferred by proper mechanical means to the printing machinery, and their types are moved by wheel-work, and brought successively into the proper position to leave their impressions on a plate of copper: this copper serves as a mould from which stereotyped plates, without limit, may be taken. Such is a very brief and imperfect outline of the lecture, which, it will be readily perceived, is of a nature extremely difficult to report.*

CARRIAGE WHEELS.

On May 27, at the Institution of Civil Engineers, Mr. Walker's paper, on the subject of the most advantageous form for wheels of different kinds of carriages, having been read, a member

* Literary Gazette, No. 907.

remarked that there were some practical objections to the use of horizontal axles, which were not alluded to in Mr. Walker's communication—one, the difficulty of making the wheel perfectly secure from coming off the axle, as a greater strain is unavoidably thrown on the linchpin. The wheels of ordinary country wagons are usually much dished, and the axles slightly inclined downwards, by which arrangement, the principal strain is thrown on the shoulder of the axletree, and a very ordinary description of linchpin will answer the purpose. As far as regards friction, and, consequently, an easy draught for the horse, the straight axle and cylindrical wheel have the preference; but, for safety, strength, and durability, he thought the inclined axle and dished wheel superior; besides which, there exists much practical difficulty in constructing carriages with horizontal axles and cylindrical wheels. It was remarked, that one reason for the conical wheel being so much adhered to in practice, was the greater liability of the tire getting loose on the cylindrical wheel by the constant rolling of a heavy weight frequently on a small extent of surface: the tire becomes slightly elongated, and, on a cylindrical wheel, gets loose, and may occasion accidents; the conical provides against this, by its greater elasticity, and the tendency it has to become more flat in the dishing, and, in a slight degree, to stretch out the periphery. It was stated that, at first, the cylindrical shape was adopted in Jones's patent iron wheels; but it was found that, with upright wheels, the width of track was required to be seven feet, and some of the streets do not admit of such a vehicle passing; also, in crowded thoroughfares, the nave is exposed, and liable to come in contact with other carriages.—It was stated, that a wheel of a new construction had lately been attempted, and was likely to become an improvement; the rim and nave are of cast-iron, and the spokes of wrought-iron; a wooden band is put round the cast-iron rim, which again is surrounded and fastened on by a wrought-iron tire, secured in the ordinary manner.—It was mentioned that, in Austria, cylindrical wheels are invariably used for wagons and heavy carriages, but for light vehicles the dished wheel is generally preferred.—A member stated, that in the neighbourhood of Edinburgh, the common stone carts belonging to the Cragleith, and other quarries, are generally made with broad cylindrical wheels.

On June 3, the conversation on the subject of the best form for wheels of carriages was resumed. An ingenious method was adopted by Messrs Jones, to exhibit the friction occasioned by conical wheels: a carriage was run upon the edges of loose boards, placed side by side: it was shown that, while the board under the middle part of the wheel remained stationary, that at the outside was pushed forward, and the board on the inside backward; such, however, can only occur when the whole breadth of the wheel touches the ground, which is seldom the

case, a wheel of nine inches having frequently a bearing of only three inches, in consequence of the middle tire being made of larger diameter.*

NEW CONCAVE ACHROMATIC LENS, ADAPTED TO THE WIRED MICROMETER.

A PAPER was read before the Royal Society, on the 27th of February, entitled, "An Account of a Concave Achromatic Lens, adapted to the Wired Micrometer, which has been named *Macro-micro*, from its power to increase the primary image of a Telescope without increasing the diameter of the wires in the Micrometer." By George Dollond, Esq., F.R.S. Of this communication the following is the official abstract, as printed in the *Proceedings of the Royal Society.*

The application of a concave achromatic lens to the wired micrometer of a telescope, arose out of the series of trials that were made for the purpose of correcting the aberrations of the eye-glasses applied to the telescope constructed by the author for the Royal Society, with a fluid-correcting lens, on the plan suggested by Professor Barlow. The concave lens, being interposed between the object-glass and the eye-glass, and being at the same time achromatic, combines the advantages of doubling the magnifying power, without a corresponding diminution of light, and without altering the apparent distances of the threads of the micrometer. The results of the trials made with telescopes to which this addition was made, are given in a letter to the author from the Rev. W. R. Dawes, of Ormskirk; from which it appears that Mr. Dollond's method was attended with complete success. Mr. Dawes states, that, in order to put its illuminating power to a severe test, he had examined with this instrument the satellites of Saturn and the minute companion of κ Geminorum, but could discover no decided difference in the apparent brightness of the former, allowance being made for the difference in the power employed; and the latter star was seen quite as distinctly with a much smaller power.

Extracts are subjoined from a letter of Professor Barlow to the author, containing formulæ for the construction of the lens.

TEAGUE'S PATENT PROCESS OF MANUFACTURING IRON.

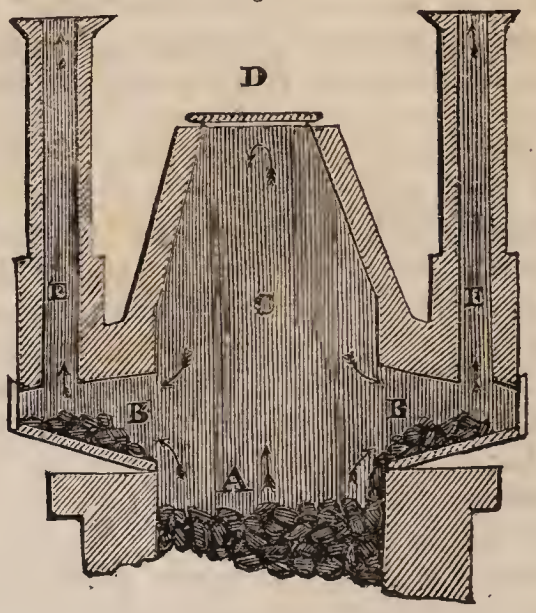
THE following invention has been recently patented, for facilitating the operation of iron-making, by Mr. Moses Teague, of Park-end, in the Forest of Dean, iron-master.

The intention of this improvement is to apply the heat and flame of the burning materials within the furnace (which have hitherto gone off into the atmosphere at the top,) to a useful purpose.

* Athenæum. No. 348.

The annexed figure 1, is a vertical section, supposed to be made directly across the centre of the top of the main furnace, and from thence upwards. Fig. 2 is a ground plan. Although the drawings are made to a scale of one-eighth of an inch to a foot, they are only intended to show the principle.

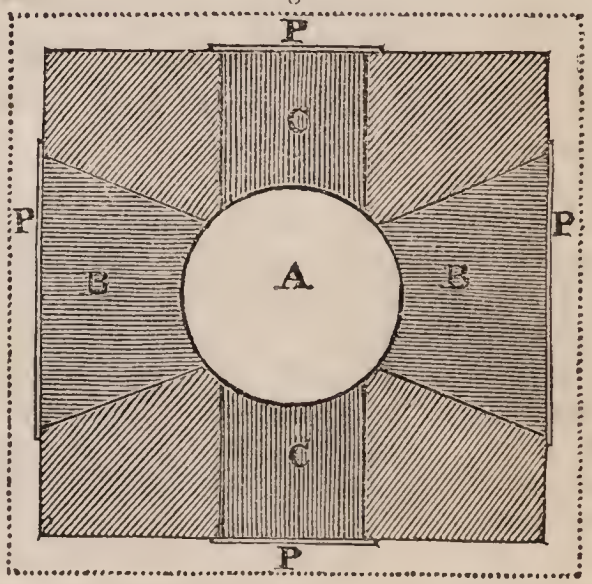
Fig. 1.



(Section of the Furnace.)

A represents the main furnace, the top part of which is to be surmounted by the new apparatus; BB are two ovens or caves, 8 feet 6 inches wide at their outer ends, narrowing to 5 feet at the inner. The bottom of these ovens are made of thick cast-iron plates, inclining towards the furnace, but at such an angle as to prevent the iron ore from sliding into the furnace by its own weight. It is in these ovens that the iron ore is deposited in its raw state, in such a quantity in each as to serve for an ordinary charge for the main furnace, but at different intervals of time, so as to suit the demand. Now it is evident that the flame and heat sent off by the combustion of the materials going on in the main furnace, must necessarily pass over and through the iron ore deposited as above described, because the doors *b b* at the mouths of the ovens, and the damper D at the top of the truncated cone C, being constantly closed, except while charging, prevent the flame and heat from going any other way than through these ovens, and finally up the chimneys E E. These chimneys are much larger the other way, so as to afford sufficient space for the escape of the flame and vapour into the atmosphere.

Fig. 2.



(Ground Plan of the Furnace.)

When it is necessary to charge the main furnace in a very hot state, one of the doors, *b*, is opened, when the iron ore is shoved forward by an iron stoker, which is speedily effected, because of the inclination of the bottom of the oven. The oven is then charged anew with raw ore, and the door is shut until the next charge. On the two opposite sides (not visible in the section, but see plan,) there is an opening in each, with doors, through which the fuel and limestone are passed to the main furnace.

The advantages sought to be obtained from this contrivance

are :—1st, the process of roasting the ore in turns, an operation of considerable expense, is dispensed with; 2ndly, instead of the ore going into the furnace in a cold state, it is by this method sent in at nearly a white heat; the limestone also gets much heated before it leaves the neighbourhood of the ovens; 3rdly, by these means the quantity of fuel and blast used must be lessened, from the bottom of the furnace to the top; and, finally, the writer is of opinion that, by this new method, the substitution of raw coal for coke, which is now getting into use in a few places, will become more general, inasmuch as it will get more heated at the top before it makes its escape downwards, by which the sulphur and other noxious matters, which some coals hold more than others, will be dissipated.

From the personal inspection which Mr. W. Brough made by mineral surveyor, and which continued for a part of two days, it struck him that the attention required to manage this new process was very little more than by the old method. The doors are exceedingly simple in their contrivance, and opened and shut with apparent ease; and the materials of which they and the other appurtenances are composed, are fire-brick, cast-iron plates, and wrought-iron bars.

Those interested may see and examine for themselves, by application to Mr. Teague, Park-end Furnaces, near Lydney.*

IRON MANUFACTURE IN FRANCE.

On April 8, at the Institution of Civil Engineers, Mr. Glynn presented a translation of a Report on the progress and improvement of the iron manufacture in France, from the French of M. Perdonnet; from which it appears, that the manufacture of iron has, of late years, much developed itself, and that this was more to be attributed to the introduction of the English method, than to any improvement in the old method. The statement commences with the present century, by showing, that there was a decrease in the production of cast-iron between 1801 and 1818, but that in the last ten years the consumption and production had nearly doubled, and the importation (chiefly Swedish and Russian) nearly tripled. The best French iron is inferior to either of those for steel. The first forge on the English plan was erected in 1820; in 1823 there were eleven at work, and four building; in 1826 there were only four blast furnaces using coke, and but thirty-one forges on the English plan: and in 1828 the number of blast furnaces had increased to fourteen, and that of forges to forty. In 1818 a very small quantity of cast-iron was made with coke, and no wrought-iron was prepared with pit-coal; but in 1824 the produce of cast-iron, with coke, was 3,000 tons, and of wrought-iron, by pit-coal, 4,400 tons were brought

* Abridged from the Mechanics' Magazine, No. 542.

into market; whereas, in 1825, there were 17,000 tons of cast-iron smelted with coke, and 48,000 of bars with pit-coal, showing that the increase of cast-iron manufactured with coke took place chiefly between 1824 and 1828. The 17,000 tons does not amount to one-tenth of the whole produce, and the 48,000 tons form nearly one-third of the total manufacture of wrought-iron. This disproportion is stated in the Report to arise from the numerous situations in which it is found advisable to make the cast-iron with wood-charcoal, and to refine it with pit-coal. Excellent sheet-iron has been obtained by passing the charcoal iron through rollers, but the tinned plate is inferior in brilliancy of surface to the English.

England produces exactly three times the quantity of cast-iron that France does, and the produce of the two countries forms a little less than three-fourths of the produce of Europe; that of bar-iron one-third. The Report gives an account of some experiments, which show, that excessive care must be taken to make cast-iron with anthracite, which is a kind of pure carbon, without any mixture of bitumen, very compact, and ignites with difficulty; but when in combustion, gives out such a heat, that it is difficult to procure materials for the furnace, which will not melt. Unless the anthracite and coke be in the proportion of seven to three, the furnaces work irregularly; and by reason of the sluggishness with which it burns, it has been found advisable to use them mixed in equal proportions. The iron produced from anthracite has always been found of excellent quality. That English iron is for many purposes superior to foreign, was proved by a member, who, having occasion to order an iron pipe to be soldered, was obliged to give a piece of English iron, the foreign iron not proving sufficiently fusible.

It is to be remarked, that English iron is prepared with coke, and foreign with charcoal. A member remarked, that he had never known better iron for the purposes of steel, than the shoeing of the piles of old London Bridge, and more particularly for etching-points. He conceived, that the iron might have undergone some chemical change while in the earth, and that being in constant contact with the charred ends of the piles, might have been benefited. A member thought the superiority of the iron at first more likely, as any contact with carbon would be counteracted by the process of conversion into steel. Walby's trowels are all made of steel, and hammered after being tempered; after they are heated, they are let down to a blue state, and then exposed to severe hammering, which gives them great elasticity and temper. A member had seen them, when red-hot, bent to a considerable extent; after which, on being set at liberty, they returned to their former shape.*

* Athenæum, No. 344.

ON THE BERLIN CAST-IRON ORNAMENTS.*

The Berlin cast-iron ornaments may be mentioned as an interesting example of the increased value of manufactured, in comparison with the raw material; and we select this manufacture the more willingly, as it had its origin in Prussia; and though many attempts at imitation have been made, has never yet been equalled in any other country. In one of the principal manufactories of this description in Berlin, that of Devaranne, such is the fineness and the delicacy of those separate arabesques, rosettes, medallions, &c., of which the larger ornaments are composed, that nearly ten thousand go to the pound. The price increases in proportion to the fineness, as will be seen by the following table, which gives the selling prices of the above named manufacturer.

	No. to the Cwt.	Price of each Article.			Price per Cwt. of the same.		
		£.	s.	d.	£.	s.	d.
1. Buckles, $3\frac{1}{2}$ inches long, and $2\frac{1}{2}$ inches broad	2,640	0	2	6	330	0	0
2. Neck-chains, 18 inches long, and 1 inch broad; and composed of 40 separate pieces,	2,310	0	6	0	693	0	0
3. Bracelets, 7 inches long, and 2 inches broad, and composed of 72 pieces	2,090 pair.	0	8	6	888	5	0
4. Diadems, $7\frac{1}{2}$ inches high, and $5\frac{1}{4}$ inches broad	1,100	0	16	6	907	10	0
5. *Sevigné needles*, $2\frac{1}{2}$ inches long, and $1\frac{1}{2}$ inches broad, and composed of 11 parts,	9,020	0	4	6	202	10	0
6. Sevigné ear-rings, 3 inches long, and $\frac{7}{8}$ of an inch broad; and composed of 24 pieces	10,450 pair.	0	5	3	2,743	2	6
7. Shirt-buttons	88,440	0	0	8	2,948	0	0

If we reckon the price of the grey iron from which these ornaments are made at 6*s.* per cwt. on an average, we find that the value of the material is increased 1,100 *times* in the *coarser* articles, and 9,827 *times* in the *finest*.

The above are the retail prices, and wholesale prices are probably one-sixth or one-eighth less: but we must remark that, compared with the old prices, the present ones have much fallen.

* From Dr. Friedenberg's German edition of Mr. Babbage's "Economy of Machinery and Manufactures."

About six years ago they were twice as high, and twelve years ago three times; so that, at that time, Berlin cast-iron was nearly of equal value with gold,—a remarkable example, and, perhaps, one of the strongest proofs of the influence of the industry of manufacturers on the wealth of the state, especially when we consider that the cast-iron ornaments are made of native material, and exported in large quantities abroad, and even, indeed, to America. It is so much the more to be regretted, that, owing to the imitation system which already prevails to a great extent, a branch of native industry, once so flourishing, should threaten to fall gradually into decay. The facility of imitation of the most saleable objects, by purchasing them at a low price, using them as models, and then casting articles of the same description, enables the imitator to offer his goods at such a low price, that the industrious original manufacturer, who has been at the expense of much time and capital in the designing and forming a brass model, finds it impossible to enter into competition with him. On the one hand, therefore, the manufacturer cannot venture to expend much capital on new models which do not repay the outlay; and, on the other, by repeated casting, the articles lose much of their sharpness and beauty, and the natural consequence (and which is already perceptible) is, that their reputation abroad must sink; and notwithstanding the moderate prices, the sale must decline. On this account, some of the best manufacturers have given up the business, and the task of improving and perfecting this branch of industry now rests in the hands of a few.

The piracy of locks is regarded as dishonourable, and against the laws; in technical manufactures new discoveries and improvements can be secured by patents; the cast-iron manufacture only is unprotected, and imitation allowed to be carried on openly and freely.*

ACCOUNT OF THE DEPTHS OF MINES.

By John Taylor, F.R.S.

Mr. Taylor, at the third meeting of the British Association, exhibited a section, showing the depths of shafts of the deepest mines in the world, and their position in relation to the level of the sea.

The absolute depths of the principal ones were:

	Feet.
1. The shaft called Roehrobichel, at the Kitspuhl mine in the Tyrol	2764
2. At the Sampson mine, at Andreasberg in the Harz	2230
3. At the Valenciana mine, at Guanaxuato, Mexico	1770
4. Pearce's shaft, at the Consolidated mines, Cornwall	1464
5. At Wheal Abraham mine, Cornwall	1452
6. At Dolcoath mine, Cornwall	1410
7. At Ecton mine, Staffordshire	1380
8. Woolf's shaft, at the Consolidated mines	1350

These mines are, however, very differently situated with regard to their

* Jameson's Journal, No. 32.

distance from the centre of the earth, as the last on the list, Woolf's shaft, at the consolidated mines, has 1,230 feet of its depth below the surface of the sea, while the bottom of the shaft of Valenciana in Mexico is near 6,000 feet in absolute height above the tops of the shafts in Cornwall. The bottom of the shaft at the Sampson mine in the Harz is but a few fathoms under the level of the ocean; and this and the deep mine of Kitspühl form, therefore, intermediate links between those of Mexico and Cornwall.

Mr. Taylor stated that, taking the diameter of the earth at 8,000 miles, and the greatest depth under the surface of the sea being 1,230 feet, or about one-fourth of a mile, it follows that we have only penetrated to the extent of $\frac{1}{32000}$ of the earth's diameter.

Some account was then given of the mines to which the shaft referred to belonged.

Of the deepest, at Kitspühl, as it has long ceased to work, we do not know much. Villefosse, in his great work on the *Richesse Minérale de l'Europe*, states that this was a copper-mine, which passed for being the deepest in Europe; and that in 1759, it was reported on, amongst other mines, by M. M. Jars and Duhamel, and it was then proposed to abandon the working, the water having been already suffered to rise near 200 fathoms.

The Sampson mine in the Herz is one of the most celebrated in that district: it has been working since the middle of the sixteenth century, and produces silver ores of superior quality. The principal shaft is sunk about six feet deeper every year, by which ground enough is drained for a regular extraction of the ores. The mine is one of the oldest in Germany, and has always been profitable: it employs from 400 to 500 men. It is the property of shareholders, who are very numerous, the interest having been much subdivided in the course of time.

The mine of Valenciana at Guanaxuato was one of the most renowned in Mexico. It produced annually about the end of the last century, 360,000 ounces of silver, worth 600,000 sterling, and then employed 3,100 persons. The shaft referred to in the section was commenced in 1791, the mine having been long previouly worked by other shafts: it had attained its present depth in 1809, when the mine was stopped by the revolution. It is octagonal, and more than 30 feet in diameter, a great part of its depth being walled with beautiful masonry, and is probably the most magnificent work of the kind. The expense of forming this shaft is estimated by Humboldt at the enormous sum of 220,000*l*. The mine was so little troubled with water, that it was considered almost a dry one; during the suspension of the works, it, however, gradually filled. In 1825 one of the English companies undertook to drain it, which was, after great labour and expense, accomplished; but the mine has not been sufficiently productive since to make it worth while to continue the working.

The consolidated mine forms the most extensive concern in Cornwall, embracing what were formerly several distinct mines, which, as the name indicates, were connected in one undertaking.

This was arranged in 1818, and the mines which had remained unwrought for many years were drained by very powerful steam-engines, and were put into a state of active working. The management was confided to Mr. Taylor and the late Captain William Davey: an outlay of 73,000*l*. was incurred, which has since been repaid with ample profit. The present produce is 20,000 tons of ore a year, yielding about 1,920

tons of fine copper, being one-seventh of the whole quantity raised in Great Britain. The mines employ about 2,400 persons, of whom about 1,400 are miners working under ground. The water raised to the adit level is about 2,000 gallons per minute: the height to which this is lifted is more than 220 fathoms, or 1,320 feet; the aggregate weight of the columns of water in the pumps being 512,000 pounds, or about 230 tons, and the whole is put in motion by eight immense steam-engines, four of which are the largest ever made.

The depth of the mines has been increased 100 fathoms since the period of the drainage being completed, being at the rate of about eight fathoms a year.

There are, in the whole concern, 95 shafts, besides other perpendicular communications from level to level under ground, called winzes. The depths of the whole added together make up about 22,000 fathoms, or 25 miles; and the levels, or galleries, will make up, in horizontal distance, a length of 38,000 fathoms, or about 43 miles.

Wheal Abraham is an old copper mine, the working of which was abandoned a few years since, the vein having ceased to be productive in depth. It was, until very lately, the deepest mine from the surface in Cornwall, but is now surpassed by the consolidated mines.

Dolcoath mine was formerly called Bullen Garden, and a section of it, as it was at that time, will be found in Dr. Pryce's work, *Mineralogia Cornubiensis*, published in 1778. It was then rather more than 90 fathoms deep, and, probably, one of the deepest mines at that time. It has, therefore, been sunk 140 fathoms since; but, like all the great mines, it has not been in constant work. It has now been actively prosecuted for many years, and, at present, stands third in the list of copper mines in Cornwall, arranging them according to the value of their produce. That of Dolcoath, however, does not amount to one half of that of the Consolidated mines.

Ecton mine is celebrated in most books on mineralogy as one of the principal copper mines in England: and it was so at one period, though the produce is now inconsiderable. It is situated in Staffordshire, on the borders of Derbyshire, and is very curious, from being in limestone and having no regular vein. The ore has been found in large masses, irregularly deposited, and is generally taken to be an example of contemporaneous formation. The mine has been regularly worked for a long series of years, and is now nearly exhausted. It is the property of the Duke of Devonshire, and very large profits were given by it in the latter part of the last century, some of which, it is said, were applied by the late Duke to the erection of the beautiful crescent at Buxton. The mine is not far distant from this place, and is in a very picturesque situation on the banks of the Manifold.

Mr. Taylor gave some account of the extent to which steam power is at present employed in Cornwall in draining the mines which penetrate so far beneath the level of the sea, showing the influence that the great improvements, which have from time to time been made, and many of them even recently, must have upon the production of some of the most useful metals.

The number of steam-engines used in pumping water from the mines in Cornwall, in December, 1832, was altogether 64.

Some of these are of immense size and power: there are five in the county, of which the diameter of the cylinder is 90 inches, the pistons making a stroke of 10 feet. Four of these are at the consolidated mines,

and the first constructed of this size was planned and erected there by Mr. Woolf. The beam of such an engine weighs 27 tons; the pump-rods are of mast-timber, 16 inches square, connected by iron strapping-plates of enormous weight. The column of water lifted, the rods, and beam, make up a weight of more than 100 tons, and this is kept in motion at the rate of from five to ten strokes per minute.

The quantity of coal consumed in drawing water in the same month in all the mines of Cornwall was 84,034 bushels, and the quantity of water delivered, about 19,279 gallons per minute. The weight of water actually poised by all these engines to produce this effect amounts to about 1,137 tons.

From calculations carefully made in Mexico as to horse power employed in draining mines, and deduced from a large scale of operations, it is found that the performance is equal to 19,000lbs. raised one foot high per minute for each horse.

According to this rate, the coal consumed in Cornwall in a month being 84,000 bushels, or 2,800 per day, and taking the duty of the engines at 55,000,000lbs. lifted one foot by each bushel, which is very nearly the fact, it will be found that the 16th part of a bushel does as much in raising water in Cornwall as a horse does in Mexico (working three hours out of 24), and that thus the number of horses required to drain the mines of Cornwall would be 44,800.

CHAIN CABLES.

On June 3, at the Institution of Civil Engineers, Mr. Manby produced a specimen of wrought-iron, two inches diameter, used for chain-cable bolts, which had been drawn into a knot while cold, without having suffered any apparent injury. This iron is not merely made from refined metal, bloomed down, but is shingled under the hammer, or rather under squeezers, made in a form similar to shears, which are thought to be equal to the hammers. Mr. Manby stated, that, at this foundry (Hartford and Co., Ebbu Vale), they make 400 tons of iron per week, and that the croppings of such a quantity of bars yields sufficient to make the bolts above alluded to. At Ebbu Vale they use cold-blast furnaces, and charred coal; the hot-blast had been tried, but time had been lost in puddling from it. Mr. Manby, however, stated, that he believed the hot-blast had not been sufficiently attended to. It was mentioned that, at this foundry, they use what are called *dandy furnaces*, and puddle on patent iron bottoms. Hartford's patent had been granted for using charcoal, or other powder, to cover the iron bottom, and so prevent the metal from adhering. Referring to the specimen on the table, Mr. Manby stated, that the ends of the bar had been merely turned over when hot, forming a hoop, and the ends passed through, so as to enable them to affix bolts; the bar was then allowed to cool, and subsequently drawn into its present form of a knot, by means of a hydraulic press; fifty-two tons pressure was requisite for the purpose, half an hour was occupied in the operation, during which time no sensible increase of temperature was observed in the metal.*

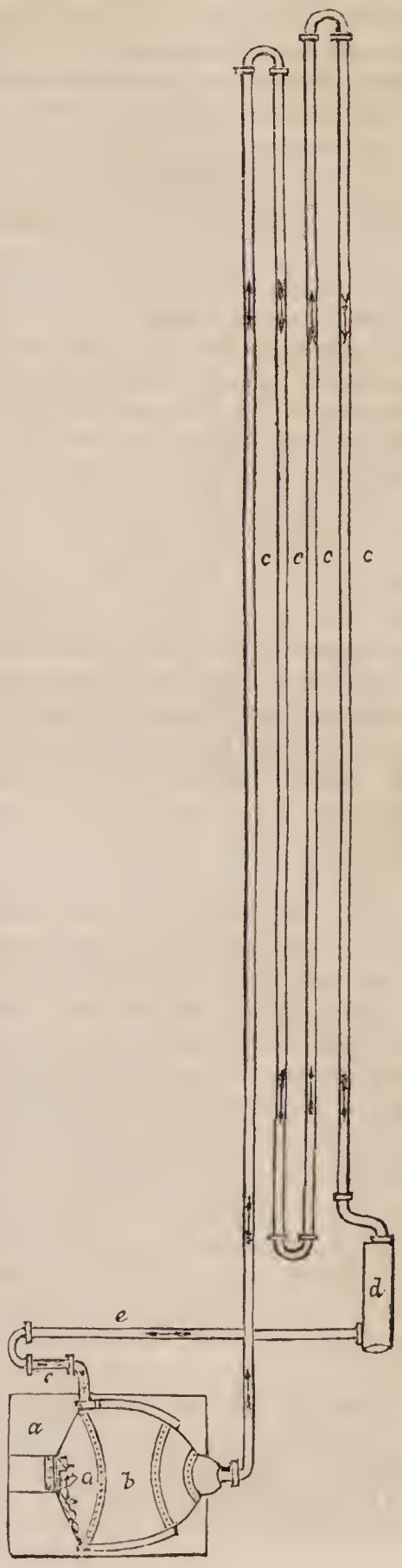
* Athenæum, No. 348.

HOT-WATER APPARATUS.

Mr. John Darkin, engineer, of Norwich, has communicated to the *Gardener's Magazine*, No. 52, the following description of a Hot-water Appratus lately invented by him.

The apparatus consists of a furnace, a boiler, cast-iron tubes of any diameter, an expansion tube, &c., as shown in the accompanying sketch. The tubes may be connected with the boiler, in any way which circumstances require, and carried in any direction, so that they do not descend below the level of the bottom of the boiler. It being understood that a given number of superficial feet of tube will throw off a certain quantity of cubic feet of hot air per minute, it can easily be ascertained, by the admeasurement of the house, and the quantity of glass in it, what quantity of tubing is required for it.

This plan certainly has a decided superiority, in every respect, over the common mode of heating by flues, and particularly in retaining *the required temperature* with a small consumption of fuel, and very trifling attention. Boiling water is much to be preferred to steam heat. A green-house, in which the apparatus is constructed, loses but a few degrees of heat by allowing the fire to go out for six or eight hours in the night. A short time is sufficient to make the water boil again, when it expands and displaces the cold water in the tubes, which are immediately supplied with hot water from the boiler, the cold water retiring through the expansion tube down



(Darkin's Hot-water Apparatus.)

a, Furnace, section. *b*, Boiler.
c c c c, Hot-water tubes.
d, Expansion tube. *e e*, Returning tube.

the returning tube, whence it is heated and again projected forward; thus keeping up a continued circulation of hot water through the tubes for a considerable time even after the fire has been allowed to die out.

This apparatus can be applied, with the best effect, to horticultural and public buildings of every description, mansions, offices, warehouses, drying-rooms, &c.; and, as the tubes have no connexion with the fire, not a particle of burned air is communicated by them to the room in which they act.

COINS AND MEDALS.

In a lecture lately delivered before the Society of Arts, Mr. Wyon described our present mode of engraving and multiplying the dies.

The selection of the best cast steel for the purpose, he observed, was very important, and not sufficiently understood at present. The very fine steel that forms excellent gravers and other cutting instruments, is unfit for the purpose, for unless hardened with great care, it is very liable to crack. The very coarse steel is also objectionable, as it acquires fissures under the die press. The object therefore is, to select steel of a medium quality—but the best steel may be spoiled, by want of skill in the smith who forges the dies.

When the rough die is brought to a table in the turning lathe, after being softened, the engraver commences his labours, by working out the device with the small tools in intaglio (sunk in), and when he has completed his work, the die is ready for hardening, which is, in itself, a very simple process—but one that is often attended with serious disappointment to the engraver, for it not unfrequently happens, that the labour of many months is either injured or utterly destroyed, from the steel itself being faulty or heated to excess. But supposing the original die, or, as it is technically called, a matrix, to be uninjured by the process of hardening, it is reserved for the purpose of furnishing a puncheon (or a steel impression in relief). For this purpose, a block of soft steel is turned flat at the bottom and obtusely conical at the top. In this state, its conical surface is compressed into the matrix by a blow from the multiplying die press: this gives us only the commencement of an impression, for the die becomes so hard by compression, as to require frequent annealing and re-striking before it is perfected. An impression taken in this way is called a puncheon, which, when the engraver has given to it all the delicacy of finish existing in the original, is then hardened, and serves for the purpose of making dies for coining, by a similar process, viz., impressing the hardened steel into that which is soft.

The distinction, said Mr. Wyon, between striking medals and coins, is very essential, so much so, that I cannot avoid saying a

few words on the subject. A medal is usually engraved in high relief, like those upon ancient coins, and it requires a succession of blows, sometimes forty or fifty, with repeated annealings, to make a perfect impression. A modern coin, on the contrary, is usually brought up with one blow, although with the disadvantage of the metal being harder. Standard gold, for instance, consists of one-twelfth of alloy: medals are usually made of fine gold; the engraving upon the coin is consequently made with a suitable degree of relief.

In striking a coin or medal, the lateral spread of the metal, which would otherwise ooze out, as it were, from between the dies, is prevented by the application of a steel collar, accurately turned to the dimensions of the dies. The number of pieces which may be struck by one pair of dies, not unfrequently amounts to between three and four hundred thousand, but the average amount is much less. Mr. Wyon stated, that he remembered instances of twenty dies being destroyed in one day, owing to the different qualities of steel, and to the casualties to which dies are liable. There are, it appears, eight presses in the coining-room of the Mint, and he considers that the destruction of one pair of dies for each press per day, is a very fair proportion, though it is generally rather more.

It must be remembered, that each press produces sixty pieces per minute, without reckoning stoppages occasioned by changing of dies and other contingences; and Mr. Wyon remarked, that in 1817, the daily produce of coins, in half-crowns, shillings, and sixpences, amounted to the enormous quantity of 343,000 per day, for three months: at that time all the eight presses were employed; but, on the 1st of last April, there were 125,000 pieces coined with five presses only. From the 4th of June, 1817, to the 31st of December, 1833, there were coined in sovereigns and half sovereigns, 52,187,265*l.* sterling.*

RESISTANCE OF FLUIDS TO BODIES PASSING THROUGH THEM.

The following notice has recently appeared of a paper entitled "An Account of a Second Series of Experiments on the Resistance of Fluids to Bodies passing through them." By James Walker, Esq., F.R.S., Civil Engineer; which was read before the Royal Society, on June 6, 1833.

The author, in a paper read to the Society in the year 1827, and printed in the Philosophical Transactions, gave an account of some experiments, showing that the resistance of fluids increases in a ratio considerably higher than the square of the velocity, and that the absolute resistance is smaller than had been deduced from the experiments of the French Academy. In the present communication he states the results of his further

* Athenæum, No. 344.

inquiries on this subject. His experiments were made at the East India Docks, on a boat twenty-three feet long and six wide, with the stem and stern nearly vertical; one end being terminated by an angle of forty-two degrees, and the other of seventy-two degrees; and the resistance to the boat's motion being measured by a dynamometer. The results are given in tables; and it appears from them, that in light vessels sharpness is more important in the bow than in the stern; but that the reverse is the case in vessels carrying heavy cargoes. From another series of experiments, the author infers that the resistance to a flat surface does not exceed 1·25lbs. for each square foot, at a speed of one mile per hour; increasing for greater velocities, in a ratio considerably higher than the square of the velocity. The author concludes with some observations on the results lately obtained in Scotland, where great velocities were given to boats moving on canals, without a proportional increase of resistance.*

EDINBURGH OBSERVATORY.

On May 6, at the Institution of Civil Engineers, Mr. Sims gave an account of the mural circle, just completed for the Observatory of Edinburgh, and treated on the advancement of the art of graduating instruments generally. After describing the earlier methods pursued in dividing, Mr. Sims stated, that about the middle of the last century, Mr. Hindley, a clock-maker of York, introduced several important improvements, and laid the foundation for that degree of perfection which has, since that period, been given to the dividing engine; he gave motion to the plate by a tangent screw, invented a frame for carrying a point, in place of using a knife against the fiducial edge of a ruler, and also introduced the elliptical cutting point. The Duc de Chaulnes was the first who made use of double microscope micrometers in operations of this nature. Ramsden's engine, for which he was rewarded by the Board of Longitude, appeared in the year 1775. He adopted Hindley's inventions of the endless screw, the cutting frame, and elliptical point: his machine, however, abounds in beautiful and ingenious contrivances.

Many engines of great excellence have since been constructed by various English artists, among whom Dollond, John Troughton, Stancliffe, and Edward Troughton, stand the most conspicuous. The celebrated Reichenbach also constructed a large and excellent engine, and introduced the great improvement of dividing the instruments on their own centres. Gambray, of Paris, followed Reichenbach, and adopted his improvements; he, however, introduced a novely, by employing a steam-engine to move every part of the apparatus. The mural circle for Edinburgh differs in no important respect from those erected at the Royal Observatory; the diameter is six feet, the length of the

* Proceedings of the Royal Society.

axis four feet, and the focal length of the telescope equal to the diameter of the circle: the divisions are cut upon a band of gold, inlaid at the circumference, and the degrees engraved upon a band of palladium, slightly alloyed with silver, to give it some degree of ductility; each space upon the circle is equal to five minutes angular measure: six microscopic micrometers, with every requisite adjustment, are attached to the face of the pier, one division of the micrometer scale being equal to a single second. Four clamps and tangent screws are so arranged round the instrument, that one of them is always at a convenient distance from the observer.

Models of a mural and transit circle were exhibited; and Mr. Sims proceeded to describe in detail the method pursued in dividing this instrument, which is summarily as follows:—

1st. Generating 256 nearly equidistant points round the circumference of the circle.

2ndly. By continual bisection of which that number admits to ascertain the quantity, in terms of a micrometer, by which every point is in error with respect to a point assumed as the zero.

3rdly. From the table of errors so constructed, and a magnified scale of equal parts, to cut the final divisions.*

STEAM-ENGINE FOR PUMPING WATER.

By W. L. Wharton.

In this engine the steam is admitted from the boiler upon a deep float, occupying the top of a column of water contained in a metallic cylinder, placed in the flue of the boiler fire. The lower part of the column of water is connected by pipes to the under side of a piston, moving water-tight in a much smaller cylinder, fixed immediately above the pumps of any mine, to the rods of which is affixed the piston rod. By this arrangement the steam always acts upon a heated surface, and its power is applied to the pump rods without the intervention of a main beam, parallel motion, &c., and, consequently, without any expense for framework and buildings requisite for their support in other engines. The friction of this engine, moreover, is very trifling, a stratum of oil being introduced both above and below the piston. A rod on wire is attached to the float, and, passing through a stuffing box in the top of the large cylinder, works the hand gear at the proper periods after the admission and escape of the steam, and consequent depression and elevation of the water and float, within that cylinder. A condensing apparatus may be added, by which the atmosphere may be rendered available, in addition to the weight of the pump rods, to force down the piston in the small cylinder, and, consequently, the water and float to the top of the large cylinder, after each stroke of the engine.†

* Athenæum, No. 348.

† Report of the Third Meeting of the British Association for the Advancement of Science.

THE DEEPEST MINE IN THE WORLD.

THE shaft at present sinking at Monkwearmouth colliery, near Sunderland, has attained a considerably greater depth than any mine in Great Britain (or, estimating its depth from the level of the sea, than any mine in the world). Pearce's shaft, at the Consolidated Mines in Cornwall, was, till lately, the deepest in the island, being about 1,470 feet in perpendicular depth, of which 1,150 feet are below the surface of the sea. The bottom of Woolf's shaft (also at the Consolidated Mines) is 1,230 feet below the sea; but its total depth is less than that of Pearce's shaft. The bottom of the Monkwearmouth shaft is already upwards of 1,500 feet below high-water mark, and 1,600 feet below the surface of the ground. It was commenced in May, 1826. The upper part of the shaft passes through the lower magnesian limestone strata, which overlap the south-eastern district of the great Newcastle coal-field, and which, including a stratum of "freestone sand" at the bottom of the limestone, extended, at Monkwearmouth, to the thickness of 330 feet, and discharged towards the bottom of the strata the prodigious quantity of 3,000 gallons of water per minute,—for the raising of which into an off-take drift, a double-acting steam-engine, working with a power of from 180 to 200 horses, was found necessary. The first unequivocal stratum of the coal formation, viz. a bed of coal one and a half inches thick, was not reached till August, 1831 (being about 344 feet below the surface), after which, the tremendous influx of water which had so long impeded the sinking operations, "was stopped back" by cylindrical "metal tubbing," or casing, fitted (in a series of small portions) to the shaft, and extending from below the above bed of coal, to within twenty-six-yards of the surface. The sinking now proceeded with spirit—still no valuable bed of coal was reached, although the shaft had passed considerably above 600 feet into the coal measures, and much deeper than had hitherto been found requisite for reaching some of the known seams. It became evident that the miners were in unknown ground. A new "feeder of water" was encountered at the great depth of 1,000 feet, requiring fresh pumps, and a fresh outlay of money. The prospects of the owners became unpromising in the eyes of most men, and were denounced as hopeless by many of the coal viewers! still the Messrs. Pemberton (the enterprising owners of this colliery) continued, and in October last reached a seam of considerable value and thickness, at the depth of 1,578 feet below the surface; and presuming that this newly-discovered seam was identified with the Bensham seam of the Tyne (or Maudlin seam of the Wear), they are rapidly deepening their shaft, in anticipation of reaching the Hutton, or most valuable seam, at no distant period, but which (if their anticipations are well founded) will be found at a depth approaching 300 fathoms from the surface! In the mean time, however, workings have very recently commenced in the supposed Bensham seam. A party of scientific gentlemen descended into these workings on Saturday last, and aided by every facility and assistance which could be afforded to them by the Messrs. Pemberton, made several barometric and thermometric observation, the details of which will be *deeply* interesting to many of our readers. A barometer at the top of the shaft (87 feet above high-water mark) stood at 30·518, its attached thermometer (Fahrenheit) being 53. On being carried down to the new workings (1,584 feet below the top) it stood at 32·280, and, *in all probability, higher than ever before seen by human eye!* the attached ther-

mometer being 58. Four workings, or drifts, had been commenced in the coal; the longest of them being that "to the dip," twenty-two yards in length, and nearly two in breadth—to the end of which the current of fresh air for ventilating the mine was diverted—(and from which the pitmen employed in its excavation had just departed), was selected for the following thermometric observations. (Temperature of the current of air near the entrance of the drift, 62 Fahrenheit; near the end of the drift, 63; close to the face or extremity of the drift, and beyond the current of air, 68.) A piece of coal was hewn from the face; and two thermometers placed in the spot just before occupied by the coal (their bulbs being instantly covered with coal-dust) rose to 71. A small pool of water was standing at the end of the drift. Temperature of this water at eleven o'clock, seventy; three hours later, sixty-nine and a half. A register thermometer was buried eighteen inches deep below the floor, and about ten yards from the entrance of the drift; forty minutes afterwards its maximum temperature was sixty-seven. Another register thermometer was similarly buried near the end of the drift, and after a similar period, indicated a maximum temperature of seventy. It was then placed in a deeper hole and covered with small coal;—some water oozed out of the side of this hole to the depth of six or eight inches above the thermometer, which, upon being examined after a sufficient interval of time, indicated a temperature of seventy-one and a half. A stream of gas bubbles (igniting with the flame of a candle) issued through the water collected in this hole; the bulbs of two very sensible thermometers were immersed under water in this stream of gas, and indicated a temperature constantly varying between 71·5 and 72·6. A thermometer was lowered to the bottom of a hole drilled to the depth of two and a half feet into the floor of another of the workings, and the atmospheric air excluded from it by a tight stopping of clay; this thermometer being raised after the lapse of forty-eight hours, stood at 71·2. Other experiments, in the prosecution of these inquiries, are contemplated.*

A Correspondent (F. B.) of the *Athenæum*, controverts one (although not a very material part) of the statements, respecting the Monkwearmouth colliery; its being called *the deepest mine in Great Britain*, an honour which, as yet, it cannot certainly claim. Pearce's shaft, at the Consolidated Mines in Cornwall, is, at the present time, 275 fathoms, or 1,650 feet, in depth, and, therefore, still maintains a slight superiority over its northern rival, being deeper by about 50 feet. This error has arisen merely from taking the depth of Pearce's shaft a year or two ago, instead of at the present time. The writer further observes, that as regards depth below the *sea level*, and, therefore (small as the approach may be), actual approximation towards the earth's centre, the Monkwearmouth colliery is correctly stated to stand unrivalled, not only in this country, but in the whole world, being, in this respect, the deepest perforation into the crust of the globe which has ever been made by man, although, in depth from the surface, it is exceeded by some few mines on the Continent.

* Durham Advertiser, November 21, 1834.

CHEMICAL SCIENCE.

ON THE PHYSICAL AND THERAPEUTIC PROPERTIES OF CHROMATE OF POTASH.

By M. Jacobson.

Neutral chromate of potash may be exposed to a very high temperature without being decomposed, unless charcoal be added to it, which renders it incandescent. Hemp, cotton, linen, or cloth, impregnated with this salt, become very combustible, and burn with strong and lively incandescence, and with considerable disengagement of light and heat. The oxides of chromium, and its different salts, possess the same property. The author has employed this property of chromate of potash for the preparation of *moxas*. Those which he made use of were made with blotting-paper, soaked in a solution made with one part of this salt and sixteen parts of water: the author proposes to make matches by immersing cotton in this solution. An important property of this salt is its great solubility in water, and its power of preserving vegetable and animal matter from putrefaction; it also removes the disagreeable smell from putrid substances.

The bichromate is especially suited for preservation and disinfection, the solution containing about 1·250 of its weight of the salt. Animal substances, with the exception of the nervous parts, are not at all altered by this solution. With respect to the therapeutic properties of chromate of potash, M. Jacobson employs it externally as a resolvent, and, when concentrated, as a caustic. Internally, taken in doses of one or two grains, it is emetic.*

DETONATION OF OXYGEN AND HYDROGEN, BY A SPARK FROM A SMALL MAGNET.

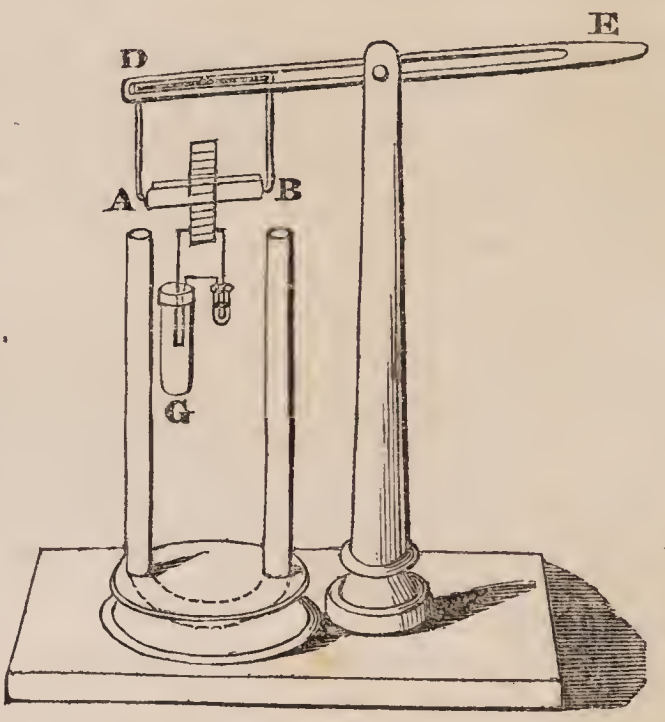
Professor Ritchie has communicated to the Philosophical Magazine the following ready method of obtaining a spark from a small magnet, sufficient to detonate a mixture of oxygen and hydrogen.

Take a short lifter, either round or square, of the worst English iron, a little shorter than the whole length across the poles of a horse-shoe magnet capable of carrying fifteen or twenty pounds, and roll a ribbon of fine copper round the middle of it, metallic contact being prevented by

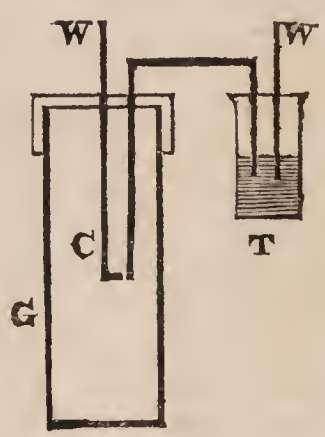
* Journal de Chimie Médicale, Février, 1834.

a thin tape interposed between the spirals. The length of the copper ribbon may be about ten or twelve feet. To the ends of the coil two thick copper wires are to be soldered, in order to form a complete metallic circuit when the lifter is in contact with the poles of the magnet. The magnet is mounted on a base or sole of wood, having a pillar with an arm or lever passing through a mortice in the top of it for the purpose of removing, by a sudden jerk, the lifter from the poles of the magnet.

The description will be best understood by reference to the annexed figure, in which A B is the lifter of soft iron, D E the lever for the purpose of suddenly raising the lifter by a smart blow given with the palm of the hand at E. In front of the magnet a glass tube, G, is placed, having its top closed by a cap of box-wood, with a hole in the centre, to allow one of the copper wires to pass through it. The other wire or end of the coil is made to play up and down in a brass tube filled with mercury. This tube has a thick copper wire soldered to it and passing through the cap in the top of the glass tube, the lower end of the wire being flattened and bent at right angles as in the annexed figure, in which G is the glass tube



W one of the wires resting on C, which is connected with the brass tube T. The other end of the coil, W, dips into the tube T, filled with mercury. The ends of the wires and the flat piece at C should be well amalgamated and covered with a clean surface of mercury. If the end of the lever be struck rapidly with the palm of the right hand, the left pressing on the short end at D, the sparks at C may be made to follow each other in rapid succession.



If a mixture of two volumes of hydrogen and one of oxygen be introduced into the tube by means of a bent or flexible tube, and the spark made to appear at C, the mixture will be exploded. If the lever be gently struck, the spark still may be made to strike off in the mixture without exploding it, whereas with a smart blow the experiment never fails.*

* Philosophical Magazine, No. 20.

CARRAGEEN, OR IRISH MOSS.*

This moss is common on rocks and stones, along the coast of Europe; it is also a native of the United States. A very variable species, but easily recognised, when the eye is accustomed to it. The genus Chondrus belongs to the order Florideae of the great natural family of the Algae. All the species have a cartilaginous frond, which is flat, without nerves, dichotomous, dilated at the extremity, and of a livid reddish colour; the fructification consists of scattered capsules, mostly immersed in the frond, rarely pedicellate; seeds minute, rounded.

This moss, abounding on the southern and western coasts of Ireland, has been used by house painters for sizing; it has, likewise, been highly esteemed by the inhabitants, as a dietetic remedy for various diseases; more especially for consumption, dysentery, ricketts, scrofula, and affections of the kidneys and bladder. Dissolved by being boiled in water, a thick jelly is produced, more pure and agreeable than that procured from any other vegetable, which is found to agree better with the stomach than any prepared from animal substances. Its chemical composition appears to me, as far as I have been able to trace it, of very considerable importance, the jelly formed by dissolving it in hot water, is not only composed of starch, but contains a large proportion of pectic acid, a considerable quantity of sulphur, and some chlorine and bromine, and another acid, combined with lime, have been discovered; the latter proves to be the oxalic acid.

Neither the fungic nor boletic, nor lichenic acids, could be detected; and the existence of iodine I have not been able, as yet, to detect. By extracting the pectic acid with caustic potassa, I found the moss taken up and altogether dissolved; and after treating the gelatinous mass with chloride of calcium, muriatic acid, and applying alcohol to separate the acid, at least 0·6 of this last was the result.

By reducing the moss to coal, and dissolving it in water, sulphuretted hydrogen gas was evolved very abundantly; protoxide of iron, subcarbonate of potassa, diluted sulphuric acid, and lime water, gave copious precipitates.

The chemical characters of this moss are too interesting to be considered as completely determined by the few superficial experiments undertaken to discover its properties, especially as they were made at a time when I have been continually interrupted by an attention to the duties of my profession; and I consider them as having been undertaken more for the satisfaction of my curiosity, than as tending to a complete and scientific investigation of such an invaluable medical substance as carra-

* Communicated by Dr. Lewis Feuchtwanger to Silliman's Journal, No. 54.

geen; but I hope to be able, very shortly, to develope, with more accuracy, the entire composition of this singular moss.

The carrageen seems to possess qualities similar to the Iceland moss, which, according to Berzelius' last analysis (a masterpiece in every respect), consists in 100 parts of 3·6 syrup, 1·9 bitartrate of potassa, tartrate, and some phosphate of lime, 3·0 bitter principle, 1·6 green wax, 3·7 gum, 7·0 colouring matter, like extract, 44·6 lichen starch, 36·2 starch-like matter; but carrageen is without bitter principle, contains nothing but soluble matter and the quantity of nutritious jelly, produced by a small portion of it, gives it the most indisputable preference.—It was first introduced by Dr. Reece, who considered it a most important article of food for invalids; and Doctors Sulby, O'Reilly, and Sir Henry Halford, speak of the carrageen as the most nutritious article of diet for invalids they are acquainted with, as well as a light, nutritious food, for delicate and weakly children. In this respect, it is certainly superior to arrow-root, sago, &c., being more highly nutritious, easy of digestion, and pleasing to the taste.

Prepared with warm milk, and sweetened, it is most particularly recommended as a breakfast for consumptive patients.

Decoction of moss, made by boiling half an ounce clear moss in a pint and a half of water or milk, until reduced to a pint, is recommended as food for children affected with scrofulous or rickety diseases, for such as are delicate and weakly, and for infants.

There are some printed directions for the manner of using the carrageen moss for medicinal and culinary purposes, accompanying some imported from England, from which I shall make here an extract.

Directions for using the Moss Medicinally.—Steep a quarter of an ounce of Moss in cold water for a few minutes—then withdraw it (shaking the water out of each sprig), and boil it in a quart of new, or unskimmed milk, until it attains the consistence of warm jelly—strain, and sweeten it to the taste with white sugar or honey, or, if convenient, with candid Eryngo Root; should milk disagree with the stomach, the same portion of water may be used instead. The decoction made with milk is recommended for breakfast for consumptive patients; and with water will be found a most agreeable kind of nourishment, taken at intervals during the day, the flavour being varied with lemon-juice or peel, Seville orange-juice, cinnamon, or wine, of any sort most congenial to the taste.

The decoction in water is also taken for the relief of cough, at any time in the course of the day, when it is troublesome; and it is, for this purpose, simply sweetened with honey.

In Dysentery, the decoction, either in milk or water, may be administered with equal advantage; and, in addition to the sweetening matter, if a tea-spoonful of the Tincture of Rhatany

be mixed with each cupful of it, tone will thereby be given to the intestines, at the same time that nourishment will be conveyed to the system, and irritation prevented—a large tea-cupful of the decoction may be taken three or four times a day.

As a pleasant strengthening food, boiled with milk, and strained, with the addition of a little sugar, it is unrivalled for infants. Persons take it in this way for breakfast or supper, with the happiest effect, who are sustaining an attack of the cholera.

Culinary Directions.—To make Blanche-Mange :—Take half an ounce of Moss, and having cleansed it by the process above described, boil it in a pint and a half of new milk, until it is reduced to a proper thickness to retain its shape ; to be sweetened and flavoured with lemon, white wine, or any thing to suit the palate.

To make Orange Lemon or Savoury Jellies:—Use a similar process, substituting water for milk—add lemon, orange, herbs, &c., according to taste.

To make White Soup :—Dissolve in water; afterwards add the usual ingredients.

It only remains to state, that the Carrageen, or Irish Moss, as a domestic article, is peculiarly interesting: it is the best thickener of milk, broths, &c.; makes excellent jellies; and for Blanche-Mange, is equal to most expensive ingredients, whilst the cost is comparatively nothing; it may be used instead of isinglass, jellies, &c.

AMMONIA IN THE VEGETABLE ALKALIES.

M. Matteucci remarks, that the existence of azote and hydrogen in the form of ammonia in the vegetable alkalies, is one of the points respecting which there is yet uncertainty. According to the analysis of Liebig, the relation between the acid and the azote of the base, is exactly the same as in ammoniacal salts ; and the vegetable alkalies, like ammonia, form true salifiable bases only when combined with water; and lastly, the salts which have a vegetable alkali for their base, are similar to ammoniacal salts as to isomorphism with other salts: from these circumstances, M. Matteucci concludes, that a part, at least, of the azote of these alkalies is in the state of ammonia. It will be readily admitted that voltaic electricity offers the most proper method of solving the question: for this purpose it is sufficient, though difficult of execution, to apportion the force of the electric current so as to separate the binary compounds without transforming them. For this purpose an apparatus, precisely similar to that used by M. Becquerel, was employed, and some pure narcotine was put upon a slip of turmeric paper moistened with æther: the same was also done with reddened litmus paper. Although the alkaline nature of narcotine is well ascertained,

yet it is well known that it does not produce the same effects as other alkalies upon the colours of turmeric and reddened litmus. After some time, the blue colour of the litmus reappears, and the turmeric is reddened. Still further to investigate this subject, sulphate of copper, in very fine powder, was mixed with pure morphia and placed on paper moistened with alcohol, which touched the copper of the small pile; in a few minutes the mixture became blue: this experiment succeeded also when a pile of ten pairs was employed. As it is impossible to believe that this ammonia is formed by the combination of the azote and hydrogen developed by the pile, the existence of this body in a state of combination in the organic alkalies must be admitted.*

SPARK DURING THE FREEZING OF WATER BY ÆTHER.

M. Julia Fontenelle states that M. Pontus, Professor at the Royal College of Cahors, has communicated to him the following observation. It is well known to chemists that if a phial, terminated by a small tube one or two centimetres long, be filled with water as well as the tube, and surrounded with cotton moistened with æther, the water freezes during the evaporation of the æther under the receiver of the air-pump. On repeating this experiment, M. Pontus remarked, that some moments before the congelation occurs, a spark, visible in day-light, escapes from the small tube which terminates the phial. This phenomenon is so generally true, that every time that he perceived the spark, he concluded the congelation was about to take place; and, on the contrary, when he did not see it, he presumed that the congelation was not near. M. Pontus was never disappointed in his conclusions. M. Fontenelle states that he also has seen the spark, and that M. Becquerel had remarked to him a similar effect at the moment of the formation of crystals in solutions.†

COMPOSITION AND SPECIFIC GRAVITY OF DIFFERENT KINDS OF GLASS.

Ordinary flint-glass, according to Mr. Faraday's analysis, consists, in 100 parts, of silica 51·93, oxide of lead 33·28, potash 13·77, with minute portions of other substances. A specimen of the same kind of glass, manufactured for telescopes by the late M. Guinand, yielded the same chemist, silica 44·3, oxide of lead 43·05, and potash 11·75. Mr. Faraday found the specific gravity of M. Guinand's glass to be about 3·616, that of ordinary flint-glass 32·90, that of plate-glass 2·5257, and that of crown glass 2·5448.

Glass has usually been considered, without much actual in-

* Ann. de Chim. et de Phys., tom. lv., p. 317.

† Journal de Chimie Médicale, July, 1833.

quiry into the subject, to be strictly a chemical combination of its ingredients, and in all respects a very perfect artificial compound. This, however, is far from being the truth, as will appear from the following facts. That the alkali in common glass of all kinds is in a very imperfect state of combination, many circumstances concur to evince. For example, Mr. Griffiths has shown, that if a small quantity either of flint-glass, or of plate-glass, be very finely pulverized in an agate mortar, then placed upon a piece of turmeric paper and moistened with a drop of pure water, strong indications of free alkali will be obtained; and that if the pulverization be very perfect, the alkali can be detected in other kinds of glass, containing far smaller quantities of it. This proves, that in whatever state of combination the alkali may be, it is still subject to the action of moisture. That flint-glass is by no means a compound resulting from very strong chemical affinities, and that the oxide of lead which it contains is as imperfectly combined as the alkali, has been shown experimentally by Mr. Faraday, and also appears from the tarnish which is produced on its surface by exposure to sulphuretted vapours, owing to the combination of sulphur with the lead. Glass which has long been exposed to the weather, frequently exhibits a beautiful iridescent appearance, and is so far decayed, that it it may be scratched with the nail. The glass of some bottles of wine which had lain in a wet cellar near the Bank of London upwards of 150 years, examined by Mr. Brande, was soft, and greatly corroded upon the surface, in consequence of the partial abstraction of its alkali. After reciting some of these facts, and others of a similar description, Mr. Faraday observes, "Glass may be considered rather as a solution of different substances one in another, than as a strong chemical compound; and it owes its power of resisting [chemical] agents generally, to its perfectly compact state, and the existence of an insoluble and unchangeable film of silica, or highly silicated matter, upon its surface." See Mr. Faraday's Bakerian Lecture on the manufacture of glass for optical purposes; Phil. Trans. 1830, pp. 46—50.*

ON THE INVESTIGATION OF MAGNETIC INTENSITY, BY THE OSCILLATIONS OF A HORIZONTAL NEEDLE.

By William Snow Harris, F.R.S.

The chief disturbing causes by which the magnetic intensity, as ascertained by the oscillations of the horizontal needle, are affected, are, 1. Variations in the air in which they are performed; 2. The influence of changes in the mechanical conditions incidental to the mode of suspending the needle; 3. Changes in the disposition and intensity of the magnetism of the needle from heat and other causes.

* Parkes's Chemical Catechism, by Brayley, pp. 127, 128.

These causes of disturbance the author proceeded to investigate.

I. He compared the oscillations of the needle vibrating in air, with those of the same needle oscillating *in vacuo*; and he minutely described the apparatus which he had contrived for allowing the needle to vibrate freely in an exhausted receiver, and his mode of determining the arcs of vibration. This apparatus enabled him to appreciate the resistance of air to the oscillations of the needle, and its effect in rendering *unequal* the duration of vibrations performed in long and in short arcs. Hence he inferred the impossibility of ascertaining the alleged diurnal changes of magnetic intensity by the common apparatus.

II. The second source of disturbance he endeavoured to obviate by a more accurate mode of suspending the needle; by which its centre of gravity and point of magnetic neutrality should be made to coincide. This the author proposes to accomplish by greater care in finding its true centre, and in adjusting its horizontality by means of small sliding counterpoises of platinum on each arm.

III. The influence of increase of temperature on the magnetic needle has generally been considered as *lowering* the tension of its magnetism; and it has been represented as again restored by cold: but the author's experiments seemed to prove the contrary, when the comparative experiments were made *in vacuo*. He considers, however, that if the needle be prepared, by being previously exposed to a variation of temperature from 212° to 0° of Fahrenheit, its tension will not afterwards be affected by ranges of temperature within these limits.

One of the most interesting parts of Mr. Harris's paper, is his mode of determining changes of magnetic tension in a particular magnet. It is well known, that if a needle be made to vibrate within a ring of copper, it will be more speedily brought to rest than if vibrating in open space. The influence of the ring of copper, therefore, might be employed to detect changes in tension, provided the force which induced motion in the needle, and that force by which it would eventually be reduced to rest *without* the ring, were both constant quantities. This, however, is not the case; but the author proposes to reverse the experiment, and cause the *ring to vibrate round the needle*, placed within it, so as just not to touch the ring. This will afford a comparative measure of the force of the needle at its poles, if we observe the influence of the needle in reducing the ring to a state of rest. A convenient mode of doing this he has given, and has deduced a general formula for estimating the differences in magnetic tension thus detected.

The author has also examined the influence of bright sunshine on the suspended needles; and has shown that the difference observed in the oscillations of the needle in sunshine and in the shade, may be made nearly to vanish in the exhausted

receiver; and he has rendered it probable, that the slight differences observed in bars oscillating in the sun's rays, are not altogether dependent on magnetism.

Lastly, the author endeavoured, by an artificial electric *aurora* in a *luminous conductor*, six feet long and four inches wide, to ascertain whether there was any effect produced on a finely suspended needle, placed within eighteen inches of the conductor; but the oscillations of the needle were not affected by a stream of electricity procured for twenty minutes from a powerful machine in this apparatus.*

PERMANGANESIATE OF POTASH.

M. Wöhler gives the following process for preparing this salt: Fuse chlorate of potash in a platina crucible over a spirit lamp: dissolve a bit of hydrate of potash in it, and add some peroxide of manganese; this also dissolves, producing a very fine green colour. There are then formed green manganesiate of potash and chloride of potassium. The mass is to be dissolved in boiling water; the green colour changes to a brilliant purple, because the manganesiate becomes permanganesiate. Decant, for the solution will not filter, and evaporate it. Small black opake crystals, with a greenish tint and a metallic lustre of permanganesiate, are obtained, mixed with chloride of potassium.

This salt is isomorphous with the heptachlorate of potash: they crystallize together in all proportions, without changing form. A few hundredths of permanganesiate of potash, mixed with a hot solution of heptachlorate of potash, give crystals of a fine ruby colour.†

ON THE ROTARY MOTION OF CAMPHOR.

By M. Charles Matteucci.

The phenomena exhibited by camphor, when put upon water, have been long known, and several philosophers have examined them; but if they are generally agreed as to the circumstances of these curious phenomena, this is not the case as to their cause. Thus, it has been said they were owing to the developement of electricity, or to the solution of camphor, and lastly, to the evaporation of the camphor and water. It is easy to prove that it is not owing to the solution of the camphor in the water, for there are several substances which are much more soluble, but which do not turn when placed on water. Nothing indicates the developement of electricity, and in this case it is not conceivable how it could produce the effect. The evaporation of water ought

* Proceedings of the Royal Society of Edinburgh, Jan. 6.

† Journal de Chimie Médicale, July, 1833.

not to be considered in the explanation of the phenomena. It is therefore entirely to the evaporation of the camphor and its solution in the strata of water which surround it, that the cause of the motion must be attributed; and it is this opinion which I propose to develope and maintain.

Potassium is a substance which, when thrown on water, resembles camphor in the phenomena it produces: in this case it is to the disengagement of hydrogen and the vapour of water that the rapid movement must be attributed. It is even possible to imitate this rotation in a more simple manner; for this, it is sufficient to throw a small piece of red-hot charcoal upon water, or a very fine metallic wire, suspended and previously heated. The motion, in this case, is produced simply by the vapour of water disengaged around the floating body. It is this hypothesis which very readily explains the suspension of rotation when a drop of oil is thrown on the surface of the water, or when it is covered with a plate of glass.

The following are the most convincing facts in favour of this explanation of the motion of camphor. I took rather a large piece of it, in order that when put upon water its motion might be very slow. I afterwards put the glass in which the experiment was made under the receiver of the air-pump and exhausted it. I then observed that the movements of the camphor, which were at first scarcely perceptible, became more rapid, and that they ceased when the action of the pump was stopped. On allowing the air to enter, the rotation occurred for some seconds, which was undoubtedly occasioned by the agitation produced by the re-entering air. Lastly, and it is the most unexceptionable proof, I have observed these phenomena of rotation on water in all volatile bodies. I took raspings of cork and impregnated them with sulphuric æther: when placed upon water these small, light bodies turned very rapidly. If it be wished to cause this rotation to continue for a long time, it is sufficient to immerse a wire in æther, and to make the other end touch the surface of the water; the æther descends as by a syphon, and the motion is continued.

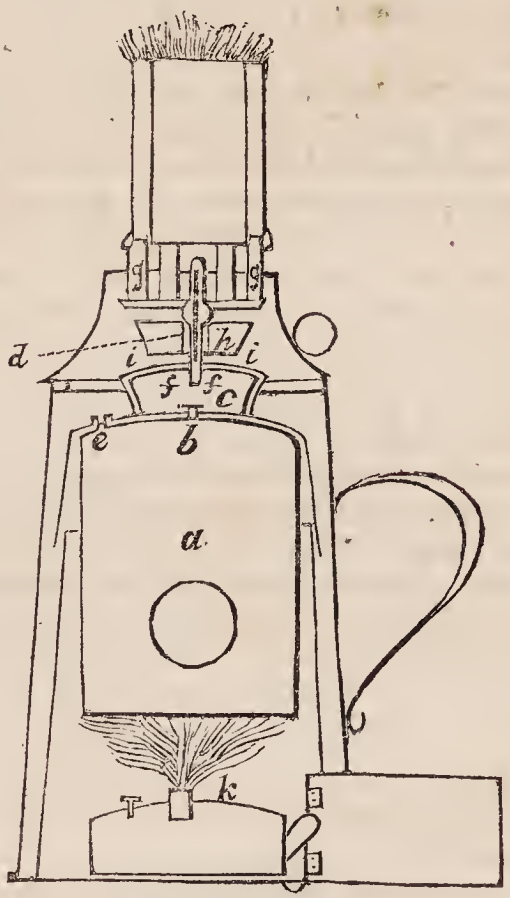
It is, then, I think, proved that the rotation of volatile bodies is owing to the currents of their vapours. I will add a word respecting the well known phenomenon produced by a stick of camphor immersed in water: I mean that of its being cut precisely according to the line which touches the exterior surface of the liquid. It is easy to prove, that of all the strata of water which are in contact with the camphor, it is in the upper that the solution is greatest. In fact, camphor dissolves in small quantity in water, but it is only at the surface that the dissolved camphor can evaporate: this water then dissolves a fresh portion, and so on repeatedly. When this solution is prevented, the phenomenon ceases to be produced. If a stick of camphor be placed in

a concentrated solution of potash, and another in water, the latter is cut in two in three or four days, and the other is not at all attacked.*

MOREY'S VAPOUR LAMP.

THE *Franklin Journal* for May contains the specification of a patent granted, in the United States, to Mr. Samuel Morey, for a lamp or apparatus for producing artificial light, constructed on a principle similar to that of Mr. Rutter's patent method of producing heat.

Mr. Morey's specification is as follows: This improvement consists of a metallic cylinder of such dimensions as may be desired, strong enough to bear a pressure of three or four pounds to the inch. In the centre of the top of this cylinder there is to be a small tube inserted, about half an inch long, with a single hole in the upper end, of about from one-twentieth to one-sixtieth of an inch diameter. Round this small tube with a single hole, there is to be another tube an inch or more in diameter, and about an inch long, soldered to the top of the cylinder, having a cap that may be screwed on, or taken off; in the centre of which cap a screw may be fastened about one-eighth of an inch or more diameter. Around this screw, and in a circle, holes are to be made, about one-fiftieth or one-sixtieth of an inch diameter, and about one-third of an inch apart. A conical tube, about three inches long, and about three-fourths or more of an inch diameter, at the lower end, having a bar across near the bottom, with a hole and screw in the centre to fit that in the lower end of the conical tube. In the top of the cylinder a safety valve is to be affixed. It is then ready for use. To use it, put into the cylinder, through the safety valve, half a gill, or more, of spirits of turpentine, and about the same of water. Apply heat to the cylinder until the vapour issues pretty freely through the conical tube on the top. If a flame is applied to that vapour, it takes fire, and burns with a beautiful white flame, like a gas-light. If there is any smoke, turn the conical tube on the top to the left, which will admit more air at the bottom to be mixed with the vapour in its ascent up the tube. As the vapour issues



(Morey's Vapour Lamp.)

* Ann. de Chim. et de Phys., tom. 53, p. 216.

through the small holes in the cap, into and through the conical tube, by the pressure in the boiler, it will mix with, and carry along through the tube, in passing along, more or less air, in proportion to its velocity, by which means it is easy to make these lamps burn with all degrees of intensity, from that of a white flame and smoke, to that of a very intense white, to blue and white, and to that of all blue, and from that to perpetual explosion. These cylinders, which may be made to hold half a pint, or many gallons, it will be well to inclose in such a manner as to preserve the heat; thin plates of tin answer well, and it will require that they be as much longer than the cylinder as will allow of a standing on the bottom under the cylinder, when desired to heat it with oil, or alcohol. It seems immaterial how, or in what method, the heat is applied, so that it is steady, and can be readily lessened or increased. To lighthouses, or wherever a large flame is required, most likely nothing will be better, or cheaper, than anthracite coal, unless the heat is applied from the same stove, or lamp, after once in operation. The flame of a lamp of alcohol, not much, if any, larger than that of a common candle, will cause vapour enough to rise or issue, to give the light of ten or fifteen candles, and heat enough to boil a two quart tea-kettle in seven or eight minutes. When the vapour issues freely and rapidly out of the conical tube, and is inflamed, it is plain to see the effect, at least, of the rapid decomposition of water. The flame will be a light blue for some inches above the tube, and on the outer edge of it there will, apparently, be a border, which has the appearance of decreasing rapidly towards the outer edge, and becomes entirely invisible in about one-eighth of an inch. The heat increases as the flame becomes less and less visible, and this is continued not only to where there is no appearance of any flame, but to a sensible distance beyond; where the heat is more intense than any where within the visible flame; which is made apparent by holding a fine wire across the flame. There does not appear to be any smell of turpentine from these lamps, unless the vapour is allowed to escape without being inflamed. Alcohol and spirits of turpentine may be made to burn in the same for many uses, particularly for lighting and warming rooms; but when alcohol is burned, it will require only about one-fifth or one-sixth of spirits of turpentine to give it the white flame; or alcohol may be mixed with water in any proportion, but the greater the proportion of water the more spirits of turpentine will be required. In the latter part of my experiments, I have generally made the covering in the form of a common tin-plate coffee-pot, as much larger than the cylinder as would allow of setting in a lamp on the bottom, through an opening on one side. The use and object of the box on the upper end of the cylinder, is to answer, in a great measure, the purpose of a gasometer in gas-works. It allows of working with much pressure in the boiler, thereby giving a much steadier issue of vapour. And as it passes into the box with a number of holes, the issue from those holes is easily adjusted, so as to have it mix with a due proportion of atmospheric air before it is inflamed, and with a velocity that will ensure its further supply, sufficient to ensure a most perfect combustion; giving to this mode great and decided advantages over all others in burning the vapours of the liquors before-mentioned, as well as all others that can be conveniently evaporated, and that are combustible; and I can see no reason why carburetted hydrogen gas may not, in this way, be burnt with a large volume of flame, without any smoke, which will, in many cases, be very useful. The great and surprising volume and quantity of light and heat given out

by these lamps and stoves, appear to me, evidently, to arise from the perpetual decomposition of the water in the combustion, and its recomposition from the air within the flame, as well as that surrounding it; which is owing, in a great measure, to the vapours of the liquors, which contain much carbon as well as hydrogen, being so intimately mixed and blended with a great supply of atmospheric air, both before it is inflamed and after, and that constantly. These lamps have this great advantage, that the same lamp can be made to burn regularly with the light of one or two candles, or twenty, or thirty, or more. Nothing can be more convenient than these lamps are for cooking, to a certain extent; with a half gill of spirits of turpentine, as much water, and one-eighth of a gill of alcohol, two, or more, two-quart tea-kettles can be made to boil in less than five minutes each, and bread toasted, and meat enough for three or four men may be boiled. In boiling meat, it will be necessary to turn the tube off laterally, a few inches, and to have the flame blue, or nearly so. So, again, nothing, I should think, could be more convenient for soldering than these lamps; for the moment you bring a piece of thin sheet copper in contact with the blue flame, having a piece of silver solder, or common silver and borax on it, the solder is instantly melted, and the copper very soon. So, also, small brass wire brought over the flame, instantly drops to pieces; and small copper wire is as soon melted, and very fine iron wire, when the mixture of air and vapour is in the best proportion, is instantly inflamed.

What I claim as my invention, and for which I ask a patent, is an improvement upon the mode of producing artificial light and heat for illumination, or other purposes, by mixing together, in suitable proportions, water, alcohol, or water and alcohol with spirits of turpentine, in a cylindrical, or other shaped, vessel, and inflaming the vapour extricated by heating the said mixture—which improvement consists principally in causing the vapour of the liquors to issue through holes from the evaporator into a small box, or reservoir, and from that box or reservoir, through such a number of very small holes, into and through a conical, or other shaped tube, with such force and velocity as will ensure its mixture with as much atmospheric air, as will, when inflamed, induce a perfect combustion,—the principles of which improvement are hereinbefore described. And I do hereby declare, that I do not intend to confine myself to any exact form or proportions in the apparatus which I employ, but to vary the same as may be desired, in any manner which admits of my operating upon the same principle, and in which a similar effect is produced.

Description of the Engraving.—*a* is a metallic cylinder; *b*, a small tube one-sixtieth inch diameter; *c*, another tube one inch diameter; *d*, screw; *e*, safety valve; *f*, small apertures through which vapour issues to the tubes; *g*, tubes; *h*, conical tube or receiver; *i*, place for the admission of atmospheric air; *k*, heat for generating vapour.

Dr. Jones, editor of the *Franklin Journal*, remarks: "The statements of Mr. Morey may be relied on most implicitly, in whatever relates to those facts which have come under his own observation; and he has been an indefatigable experimenter and observer, more especially as regards the production of flame by the combined action of alcohol, essential oils, and water."

Professor Silliman likewise observes: "We have seen some of Mr. Morey's experiments, and can testify to the correctness of

his statements, as regards the great amount of heat and light evolved by combustion of the vapour of water mixed with that of spirits of turpentine or alcohol, and duly modified by common air. The results are very striking and beautiful, and we can see no reason why they should not prove of great practical utility."*

SEPARATION OF OSMIUM AND IRIDIUM.

M. Person gives the following as a simple and easy process for separating osmium and iridium: Mix one part of the insoluble residue of platina (osmium and iridium) with two parts of carbonate of soda, and two and a half parts of sulphur: calcine the mixture, and lixiviate the product. He obtains by this process sulphurets of osmium and iridium, which are to be mixed with three times their weight of sulphate of mercury, and the whole is to be put into a retort, furnished with an adopter and receiver, and the retort is to be made red-hot. All the osmium volatilizes, and passes into the receiver in the state of a blue oxisulphuret; part of it also remains in the neck of the retort, combined with mercury and oxygen. By heating both these compounds in hydrogen, metallic osmium is obtained: the iridium remains in the retort in the state of oxide. Sometimes it retains traces of osmium which are to be separated by potash: from the pure oxide iridium is easily obtained.†

RECENT DISCOVERIES IN ORGANIC CHEMISTRY.

By William Gregory, M.D.

The author, in this paper, communicated to the Royal Society of Edinburgh an account of Creazote, a new organic principle lately discovered by M. Reichenbach, which possesses remarkable antiseptic properties, and is the source of the antiseptic power of wood-smoke, empyreumatic pyroligneous vinegar, and other empyreumatized substances; also of a very volatile fluid, lately put into his hands by Mr. Enderby, of London, which is obtained by the destructive distillation of caoutchouc, and possesses, in a higher degree than any other menstruum, the property of dissolving that substance; and lastly, of three new crystalline bodies which have lately been discovered by M. Robiquet, and other French chemists, in opium, and which are named Narceïne, Meconine, and Codeïne. Specimens of the several substances were exhibited.

The author stated, more particularly in regard to the last of these principles, that, although in common with the two other newly discovered principles of opium, it constitutes an extremely small proportion of that drug; it may be obtained in a tolerably

* Quoted in the Mechanics' Magazine.

† Journal de Chimie Médicale, July, 1833.

large quantity from the muriate of morphia of commerce, which appears to contain about a thirtieth of codeine.

From experiments made on various healthy individuals with codeine, obtained in this manner, he is led to infer, that in the doze of three, four, or five grains, it is distinctly stimulant in its action, and to suspect that it may be in part the cause of the disagreeable exciting effects produced by opium in some particular constitutions.*

TEST FOR HYDROCYANIC OR PRUSSIC ACID, AND METHOD OF APPRECIATING THE QUANTITY.

We are informed by Mr. John T. Barry that the nitrate of silver, in common with other salts of that metal, is so extremely delicate a test of the presence of hydrocyanic acid, that its detection is not difficult in a drop of water containing far less than *the ten thousandth part of a grain* of that poisonous agent. For instance, if one minion of the dilute medicinal solution be mixed with a pint of water, its presence may be demonstrated in a single drop of the mixture. But what is of more consequence is, that although the mixture be contaminated with various organic substances, such as those contained in articles of diet, milk, coffee, tea, porter, wine, and soups, so far as is yet known, the test retains its sensibility unimpaired. Mr. Barry, however, thinks that this extreme sensibility, while it renders the evidence of the silver test conclusive as to the *absence* of prussic acid, will be of more limited service in establishing its *presence*, for, without adverting to the possibility of other volatile substances being hereafter discovered to have a similar effect on solution of silver, it is to be borne in mind that this reagent indicates the existence of prussic acid in some esculent substances where it had previously been found, as well as in some new ones. Upon this branch of the subject medical jurists will probably think it right to collect information.

The application of the solution of silver is simple. The suspected fluid is to be acidulated by the addition of acetic acid, but so as to redden litmus paper in only the *slightest degree*. If excess of acid be already present, it is to be *not quite* neutralized by carbonate of soda. These precautions are adopted to retard the interference of ammonia or muriatic acid. Two or three drops, quite cold, are then put into a watch-glass, and immediately covered by a plate of glass, whose under surface, to the breadth of a pea, is moistened with solution of nitrate of silver, formed by dissolving one grain lunar caustic in 100 grains distilled water.

If the inverted drop of silver solution retain its transparency unaltered, the *absence* of prussic acid is established; for had it been present, the silver solution would in a few moments have become clouded by the formation of a *white* precipitate, an effect

* Proceedings of the Royal Society of Edinburgh, Feb. 3.

which, indeed, is almost instantaneous when the prussic acid is not excessively diluted. If, on the other hand, the precipitate appear, the conclusion must not be drawn that it is *cyanuret* of silver, until identified as such by two properties :—first, its speedy *re-solubility*, as denoted by the clouded drop becoming again clear, when *placed over* a vessel of caustic ammonia, in which respect it differs from the silver compounds of iodine and bromine :—and secondly, in retaining *unchanged* its pure white colour after exposure a few minutes to the sun's rays, or for a longer time, to day-light. As this property essentially distinguishes it from the compound of silver with chlorine, it is important to establish it by a separate experiment upon a somewhat larger portion of the precipitate, which should be obtained, by candle-light, by successively placing the inverted drop of nitrate of silver over renewed portions of the liquid in a saucer: as soon as the precipitate separates into distinct curd-like particles, it is ready for exposure to the solar rays.

Another property which distinguishes the cyanide (or cyanuret) of silver from the chloride, is, that upon being ignited in an open short glass tube, the cyanogen burns with a flame of the usual colour, leaving the metal pure, if sufficiently heated,—a quality the more valuable as it furnishes an index to the *proportion* of prussic acid it represents, which upon ordinary occasions may be estimated as equal to one-fourth the weight of residual silver.

When, acting upon this principle, it is desirable to ascertain the *entire* quantity of prussic acid, it is to be obtained by slowly distilling over, in nearly filled close vessels, about an eighth of the acidulated mixture under examination; rectifying it; re-acidulating by acetic acid; precipitating by *slight* excess of nitrate silver; washing with distilled water, only so long as the washings affect litmus paper; drying at 212°; weighing :—and lastly, igniting and re-weighing.

The medicinal solution above referred to (as to be diluted for experiment in the proportion of one drop to the pint of water,) contains, in round numbers, nearly a sixteenth of its own weight of anhydrous prussic acid, or rather less than four grains in the drachm, being the article (commonly designated "of Scheele's strength,") as manufactured by some respectable houses in London. We understand that Messrs. William Allen and Co., by means of silver as a reagent, have uniformly concentrated it to this degree since the year 1820, when Mr. Barry introduced the use of that metal to determine and regulate its proportion of absolute prussic acid by the formation of cyanuret of silver. The method being one which admits of extreme precision, will deserve the attention of the College of Physicians, if prussic acid be inserted in the next Pharmacopœia. It is to be recollected that this preparation, like those of alcohol or æther, is subject to variation, notwithstanding any superiority of formula, or care on the part of the operator. Hence the necessity of means for as-

saying the final product and for reducing it to a uniform standard. With regard to the employment of cyanuret of potassim for the occasional formation of hydrocyanic acid, it is a question which at least deserves very serious consideration. Its disposition to absorb atmospheric moisture, and always to become more or less converted into carbonate, while its cyanogen (united to hydrogen,) to an uncertain extent is dissipated, especially when this beautiful salt is much disintegrated, constitute formidable difficulties. But a still greater objection will present itself at the counters of apothecaries and chemists where medicines are made up, from the possibility of this intensely poisonous salt being sometimes mistaken for other substances, in the frequent extemporaneous production of prussic acid.*

ACTION OF TANNIN AND SOME OTHER SUBSTANCES ON THE ROOTS OF PLANTS.

By M. Payen.

It has been repeatedly stated by M. Silvestre, Jun., that trees soon died when their roots came into contact with the remains of the roots of oak trees cut down near them. This was supposed by some to be owing to the action of tannin, while others maintained that it was innocuous. M. Payen instituted direct experiments on this subject. In order to observe the influence of tannin and to appreciate its effects comparatively with those of other agents, M. Payen placed grains of wheat, rye, barley, oats, and maize, in contact with equal quantities of the following liquids, and all other circumstances were equal:—1st, aërated distilled water; 2nd, the same containing 0·01 of its weight of a saturated solution of carbonate of soda; 3rd, the same containing only 0·001 of its weight of the same saturated solution of carbonate of soda; 4th, a solution containing 0·001 of pure tannin; 5th, a solution containing 0·001 of sulphuric acid; 6th, distilled water saturated with lime.

In the distilled water, in the liquid containing 0·001 of solution of carbonate of soda, and in the solution of tannin, germination took place in the order stated; in the three other liquids, those containing 0·001 of acid, 0·001 of carbonate of soda, and saturated with lime, germination did not occur.

The distilled water soon became slightly acid. The developement of the stalks, at first rather more rapid than in the solution of 0·001 of carbonate of soda, slackened comparatively with that which occurred in the last liquor: when this was neutralized by the acid excreted by vegetation, the original quantity of alkali was added. In bitter liquids, the white roots and green stalks were several centimetres long in a fortnight.

In the solution of 0·001 of tannin, all the radicles gradually

* Philosophical Magazine, No. 20.

acquired a brown tint, and were but slightly and imperfectly developed. The plumulæ continued whitish, but did not develope any green stalks; there was therefore a strongly marked obstacle to any further developement in this liquid.

M. Payen concludes from the preceding and other experiments, that,

1st, Tannin, even in small quantity, acts deleteriously on the roots of certain plants:

2ndly, Acids in small proportion are hurtful to germination:

3rdly, Alkalies in small quantity are favourable to the progress of vegetation:

4thly, The saturation of the acidity developed during germination hastens its progress and favours the ulterior developement.

These experiments account for one of the useful effects of lime, of vegetable ashes and calcareous marl, and for the unfavourable influence of alkalies used in too great quantity, or unequally distributed.*

METEORIC IRON.

On Nov. 21, a paper was read before the Royal Society, entitled "Historical Notice of the supposed Identity of the large mass of Meteoric Iron now in the British Museum, with the celebrated Otumpa Iron described by Rubin de Celis, in the Philosophical Transactions for 1786," communicated in a letter from Woodbine Parish, jun., Esq., F.R.S., to Charles Konig, Esq., Foreign Secretary of the Royal Society.

The mass of iron in question was transmitted to Buenos Ayres, for the purpose of being manufactured into fire-arms, at the period when the people of that country declared themselves independent of Spain; but a supply of arms having in the meanwhile arrived, it was deposited in the Arsenal, and afterwards given to Mr. Parish, who transmitted it to England. Its identity with the mass of iron described by De Celis, though probable, is not exactly determined.

EXPERIMENTS TO MEASURE THE VELOCITY OF ELECTRICITY, AND THE DURATION OF ELECTRIC LIGHT.

By Charles Wheatstone, Esq., Professor of Experimental Philosophy in King's College, London. Communicated to the Royal Society by Michael Faraday, Esq., F.R.S.

The continuance for a certain time of all luminous impressions on the retina prevents our accurately perceiving, by direct observation, the duration of the light which occasions these impressions; but by giving the luminous body a rapid motion, which produces the appearance of a continued train of light along the path it has described, its condition at each moment

* Journal de Chimie Médicale, April, 1834.

may be ascertained, and consequently its duration determined. The same law of our sensations precludes us from direct perception of the velocity with which the luminous cause is moving, as the whole of its track, for a certain distance, appears to be equally illuminated; but by combining a rapid transverse motion of the body from which the light proceeds, with that which it had before, its path may be lengthened to any assignable extent, and both its duration and its velocity will admit of measurement. The author gives various illustrations of this principle, and of his attempts to apply it to appreciate the duration and the velocity of the electric spark. His first experiments were made by revolving rapidly the electric apparatus giving electric sparks; but in every instance they appeared to be perfectly instantaneous. He next resorted to the more convenient plan of viewing the image of the spark reflected from a plane mirror, which, by means of a train of wheels, was kept in rapid rotation on a horizontal axis. The number of revolutions performed by the mirror was ascertained, by means of the sound of a siren connected with it, and still more successfully by that of an arm striking against a card, to be 800 in a second. The angular motion of the image being twice as great as that of the mirror, it was easy to compute the interval of time occupied by the light during its appearance in two successive points of its apparent path, when thus viewed; and it was ascertained that the image passed over half a degree (an angle which, being equal to about an inch, seen at a distance of ten feet, is easily detected by the eye) in the 1,152,000th part of a second. The result of these experiments, as regarded the duration of the spark, was that it did not occupy even this minute portion of time; but when the electric discharge of a battery was made to pass through a copper wire of half a mile in length, interrupted both in the middle, and also at its two extremities, so as to present three sparks; they each gave a spectrum considerably elongated, and indicating a duration of the spark of the 24,000th part of a second. The sparks at both extremities of the circuit were perfectly simultaneous, both in their period of commencement and termination; but that which took place in the middle of the circuit, though of equal duration with the former, occurred later, by at least the millionth part of a second, indicating a velocity of transmission from the former point to the latter, of nearly 288,000 miles in a second; a velocity which exceeds that of light itself.*

DISCOVERY OF PLATINA IN FRANCE.

M. Villain has informed the Academy of Sciences of the discovery of a great mine of argentiferous galena: it is the mine of Melle, or Mello, situated in the department de Deux Sevres. The mine contains two varieties of the ore, one with large facets,

* Proceedings of the Royal Society, June 14.

and the other very brilliant steel-grained ore. The former contains from 40 to 66 per cent. of lead: in cupelling the silver M. Villain obtained a blackish residue, which he suspected to be platina and iridium. Some of the samples of galena contained $\frac{22}{100,000}$ of its weight of platina, or 100 pounds of the lead should contain 1 ounce 7 gros and 46 grains of platina, and it is calculated that the daily product of platina will amount to 1 pound 4 ounces 2 gros and 28 grains. The steel-grained variety contains most platina.*

EXPERIMENTS ON MAGNETIC INTENSITY MADE AT LIVERPOOL AND MANCHESTER.

By Dr. Traill.

Dr. Traill made a report to the Society of experiments made by him in 1832, at Liverpool and Manchester, on magnetic intensity, measured by the oscillations of the horizontal needles belonging to the Society, which had been sent to him for that purpose. The reporter also stated the result of a series of experiments made by Professor Oersted and himself in Liverpool in 1823, which is important, as having been made use of by Professor Hansteen in constructing his *isodynamic magnetic lines* for Great Britain.

The result of Dr. Traill's experiments is, that Hansteen has estimated the magnetic intensity of England a little too high, as Mr. Dunlop found he had that of Scotland; and the reporter concluded that this arose from the experiments on which Hansteen founded his calculation being affected by some degree of local attraction, from the confined spaces in which the experiments were made.

The magnetic intensity, as deduced from the time of 300 vibrations in the reporter's experiments with the Society's needles, is, with Hansteen's cylindrical needle,

At Liverpool, mean of three series = 798″·21
At Manchester, from one series.. = 798· 82

With Dollond's flat needle,

At Liverpool, mean of three series = 1052·83
At Manchester, from one series .. = 1051·76

The reporter also stated, that the magnetic dip at Liverpool, as ascertained by several experiments made there by Lieutenant Allen, R. N., and himself, with a needle furnished by the Board of Admiralty, for the late expedition up the Niger, is = 72° 2′ 24″.

The experiments on the dip, as well as two other series on

* Journal de Chimie Médicale, Feb. 1834.

magnetic intensity with a horizontal needle belonging also to the Admiralty, were made on the same spot as those with the Society's needles, viz., an open space in the Botanic Garden at Liverpool.*

ANALYSIS OF THE MOIRA BRINE SPRING NEAR ASHBY-DE-LA-ZOUCH, LEICESTERSHIRE, WITH RESEARCHES ON THE EXTRACTION OF BROMINE.

By Andrew Ure, M.D., F.R.S.†

The water derived from the spring in question is raised by means of a pump from the coal mines in the neighbourhood of Ashby-de-la-Zouch, is much used as medicinal baths, and is also administered internally, principally as a remedy for bronchocele and scrofulous tumors. The result of the analysis made by the author, is that it contains per gallon,

	grs.
Bromide of sodium and magnesium	8·
Chloride of calcium	851·2
———— magnesium	16·
———— sodium	3,700·5
Protoxide of iron, a trace	
Solid contents	45,75·7

After removing from the water the deliquescent chlorides of lime and magnesia by the addition of carbonate of soda, he transmits, through the mother liquor, consisting of chloride and bromide of sodium, a current of chlorine gas, till it communicates the maximum golden tint, and then adds sulphuric æther, which, by agitation, carries with it to the surface the bromine and chlorine, constituting a reddish yellow stratum. The proportion in which these two elements exist in the evaporated solution may be ascertained with the greatest nicety by the addition of a solution of nitrate of silver; the method of calculation for this purpose being detailed by the author.‡

DISCHARGE OF THE STAIN OF INDELIBLE INK, BY CORROSIVE SUBLIMATE.

Dr. John Dickson, of South Carolina, states that Mrs. Dickson had accidentally observed the discharge, by corrosive sublimate from a handkerchief, of the colour produced by the nitrate of silver; and it was soon found that the same effect was pro-

* Proceedings of the Royal Society of Edinburgh, Jan. 6.

† See an abstract of Prof. Daubeny's paper "On the occurrence of Iodine and Bromine in certain mineral waters of South Britain," in Phil. Mag. and Annals, N.S., vol. viii., pp. 61, 62.

‡ Proceedings of the Royal Society, June 6.

duced upon linen, cotton, and the human skin. On the cloth,* the stain partially reappeared after washing, but on the skin it did not return.

The following circumstances led to Mrs. Dickson's observation:—A weak solution of nitrate of silver (warmly recommended in Eberle's Practice) was used as a lotion in treating some cases of erysipelas; its power of producing a dark tint was well known to Dr. D., but as no caution is given in the above work, it was presumed that no such consequence would follow from using so weak a solution: but Dr. D. had the mortification to find the effect produced, and a solution of corrosive sublimate was then successfully applied to remove the stain produced by nitrate of silver. The following suggestions are made by Dr. D.

1. Not to use the nitrate on the face at all, especially in the case of females.

2. To take care that the solution reach only the portions of the surface that are in a state of erysipelatous inflammation, since there is reason to believe that it is less likely to stain the inflamed part, and, at any rate, vesication, desquamation, or absorption, will soon remove the skin and stain together in the diseased surface, while this will not happen so soon in the healthy portion. Of course, this is not of so much importance in parts habitually covered by the dress.

3. To have the parts to which the nitrate is applied protected from the light during the use of it.

4. To wash away the solution, before it dries in the least, from the fingers, &c., dipped in it in making the application. This may be done in common clean water, and if not effectually done in that, it may be certainly done in a weak solution of corrosive sublimate, as appears from our experience.†

INDELIBLE INK PREPARED FROM VANADIUM.

The following account is given by Berzelius, of a new and almost indelible ink, applicable to all common purposes, which he has prepared from the recently discovered metal, vanadium. The vanadates of ammonia, that is the combinations of the acid, formed by this metal with oxygen, united to the alkali ammonia when mixed with infusion of galls, form a black liquid, which is the best writing ink that can be used. The quantity of salt necessary for a perfectly black ink is so small, that it will be not worth considering, when vanadium is more generally known. The writing obtained with this ink is perfectly black. Acids render it blue, but do not obliterate it like common writing ink; the alkalies when sufficiently diluted not to act upon the paper, do

* It is not specified what cloth is intended, but it is presumed that it is the fibre of the linen and cotton.

† Silliman's Journal, No. 54.

not dissolve it, and chlorine, which destroys the black colour, does not, however, efface the writing, even when water is afterwards suffered to run over it. In a word, if this ink is not perfectly indelible, it strongly resists reagents which instantly cause common ink to disappear; added to which it is blacker and flows better, because it consists of a solution, and not of a precipitate suspended in a solution of gum. It remains to be proved what the effects of time will be upon it.*

ON THE THERMOSTAT, OR HEAT GOVERNOR, A SELF-ACTING PHYSICAL APPARATUS FOR REGULATING TEMPERATURE.

By Andrew Ure, M.D., F.R.S., &c.

This instrument acts by the unequal expansion of different metals in combination: it admits of many modifications of external form, but in all, the metallic bars must possess such force of flexure in heating or cooling as to enable their working rods or levers to open or shut valves, stopcocks, and ventilating orifices.

Steel and zinc are the two metals employed: they possess a great difference of expansiveness, nearly as two to five, and are sufficiently cheap to enter into the composition of thermostatic apparatus; but zinc has, in reference to the present object, one property which should be corrected. After being many times heated and cooled, a rod of that metal remains permanently elongated. This property may, however, be in a great measure destroyed, and considerable rigidity acquired by allying it with four or five per cent. of copper and one of tin. Such an alloy is hard, close grained, elastic, and very expansible, and therefore suits pretty well for making the more expansible bar of a thermostat.

Let a bar of zinc or of this alloy be cast, about an inch in breadth, one quarter of an inch thick, and two feet long, and let it be firmly and closely riveted along its face to the face of a similar bar of steel of about one-third the thickness. The product of the rigidity and strength of each bar should be nearly the same, so that the texture of each may pretty equally resist the strains of flexure. Having provided a dozen such compound bars, let them be united in pairs by a hinge-joint at each of their ends, having the steel bars inwards. At ordinary temperatures the steel plates of such a pair of compound bars will be parallel and nearly in contact, but when heated they will bend outwards, receding from each other at their middle parts, like two bows tied together at their ends. Supposing this recession to be one inch for 180° Fahrenheit, then 6 such pairs of bows, connected together in an open frame with rabeted end plates, and with a guide-rod playing through a hole in the centre of each, will produce an effective aggregate motion of six inches, being half an

* Parkes's Chemical Catechism, by Brayley, p. 564.

inch for every 15° Fahr., or $8\frac{1}{3}$° C. Instead of limiting ourselves to half a dozen such pairs of compound bars, we may readily lodge in a slender iron frame a score or two of them, so as to furnish as great a range of motion as can be desired for most purposes of heat regulation; and the power of pressure or impulsion may be increased, if necessary, by increasing somewhat the thickness of each component lamina. One extremity of the series must obviously be firmly abutted against a solid fulcrum or bearing, while the opposite extremity gives motion to a working rod of a suitable kind.

The author of the communication then describes in detail the various mechanical adjustments by which the apparatus may be applied to maintain any determined rate of ventilation through the casements of church windows; to give alarm and open valves in water-cisterns in case of fire; to preserve a certain rate of combustion in furnaces, a uniform temperature in baths and stills, and to act as a safety-valve for a steam-engine.*

NEW ACID IN NUX VOMICA.

M. Coriol has discovered an acid in nux vomica which forms a very soluble salt with lime. It crystallizes in a granular mass in the aqueous extract of nux vomica, treated with alcohol; the acid may be separated from the lime by oxalic acid. He has also found another acid in the nux vomica, which he is about to examine.†

PETROLEUM, OR MINERAL OIL.

Dr. Reichenbach has obtained, from a series of experiments, the following general results respecting the origin of petroleum, or mineral oil.

1st, The coals of the great coal formation contain about $\frac{1}{320{,}000}$ of an etherial oil, which can be distilled by means of water alone. The coals of the quadersandstone formation (greensand) do not contain it.

2. This oil is physically and chemically identical with petroleum, which therefore

3. Existed previously, already formed, in coals: and therefore,

4. Is no product either of the carbonization or combustion of coal.

5. The artificial mineral oil presents so many points of analogy with turpentine oil, both in a physical and chemical point of view, that,

* Report of the Third Meeting of the British Association for the Advancement of Science.

† Journal de Chimie Médicale, March, 1833.

6. Mineral oil is very probably the turpentine oil of the pines of an early period in the geological history of the globe.*

7. Petroleum wells appear to be feeble distillations of large beds of coal, and produced by the universal subterranean heat of the globe.

8. Coal beds have never been subjected to a high temperature.

9. Eupion and mineral oils are quite distinct; rectified coal-tar, however, as it is prepared for dissolving caoutchouc, contains, besides other substances, a mixture of mineral oil and eupion.†

OIL OF COPAIVA AS A TEST FOR THE PURITY OF THE SULPHURIC ETHER.

If ether is not fully deprived of water and alcohol, it forms, when united with oil of copaiva, an emulsion, without dissolving it completely; whereas it is soluble, when pure, in every proportion.‡

APPARATUS FOR INSTANTANEOUS LIGHT.

Mr. J. Boynton, of High Holborn, has patented the following Improvements in Apparatus or Means of producing Instantaneous Light.

In ordinary apparatus or means of producing instantaneous light, by dipping a match into acid, it is well known, that when the cover or stopper of the bottle, or vessel, containing the acid, is left off for any length of time, the effective property of the acid is quickly destroyed by the action of the atmosphere, and from the well known destructive properties of the acid on most substances, it is desirable to use a substance as a stopper, or cover, which is not prejudicially acted on by the acid. Mr. Boynton's invention is intended to obviate both these objections to the ordinary apparatus or means for producing instantaneous light wherein acid is used; and his improvements consist, first, in the application of quicksilver as a covering to the acid for the purposes of excluding the action of the atmosphere from destroying the effective properties of the acid, at the time of the bottle, or other vessel, being left unstopped or uncovered. Secondly, in the application of talc as a covering or stopper to the bottle, or vessel, containing acid used for the purpose of producing instantaneous light.

* The resemblance of mineral oil to the turpentine oil of pines is a fact illustrative of the important observations of Nicol of Edinburgh in regard to the coniferæ of the great coal formation of Britain, New Holland, and other countries.

† From Schweigger Seidel's N. Jahrbuch der Chemic und Physik. Heft. 1. B. ix. 133.

‡ Silliman's Journal, No. 54.

Fig. 1, represents an apparatus for producing instantaneous light, *a*, being a box shown in section, and *b*, the cover. This box is intended to contain a supply of the ordinary matches. On the top of the cover, *b*, is inserted the bottle, *c*, containing the acid. Into the mouth of this bottle, *c*, is inserted and cemented the tube, *d*, for the purpose of preventing the quicksilver from flowing out in the event of the apparatus being turned over. *e*, represents the quicksilver which lies on the top of the asbestus, which contains the acid. By this, it will be evident that the atmosphere will not be able to come in contact with the acid, by which means its properties will be preserved for a very considerable length of time, even though the cover, or stopper, be left off the bottle or vessel. In using this apparatus, the match is to be dipped quickly through the quicksilver, and hastily withdrawn, the quicksilver flowing back and again covering the acid as the match is removed, and thus preventing the atmosphere acting on the acid.

1

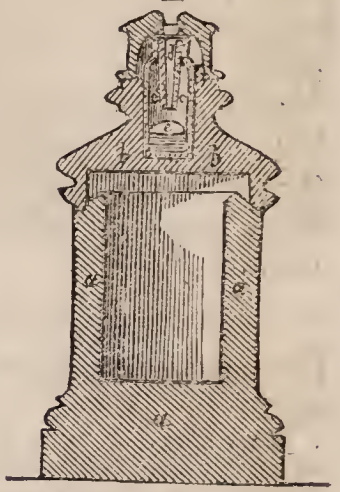
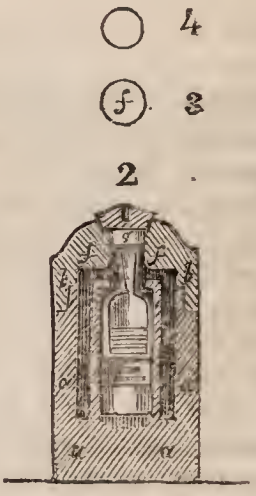


Fig. 2, represents the second improvement, in which figure the same letters of reference indicate similar parts; it will not, therefore, be necessary to again describe them, but merely the application of talc as a cover, or stopper, to the bottle. *f*, fig. 3, is a disc of talc which is affixed at that part of the top of the cover, *b*, which comes in contact with the mouth of the bottle, or vessel, containing the acid, the bottle being constantly pressed upwards by the spring, *h*.

Fig. 4, represents a disc of foil, or thin metal, which is placed on the talc. *g*, is a piece of cork, which forms an elastic back to the talc cover, or stopper.*



THE DRUMMOND LIGHT.

On April 16, there was, at the National Gallery of Practical Science, literally, a most brilliant exhibition of Lieutenant Drummond's intense lights, applicable to light-houses, telegraphic signals, geodætical operations, and all purposes which require such light to be visible at great distances. Many hundreds of the most distinguished patrons of science, and eminent practical scientific men, were present on this interesting occasion; and the series of experiments were conducted with extraordinary effect.

There was exhibited an Argand lamp, with parabolic reflectors of such prodigious splendour, that, as it revolved, it has been visible forty-four miles off; but even this was incomparably excelled by one of the new combinations, so dazzling that no eye could bear to gaze upon it in the line of reflection; and it was

* Repertory of Inventions, No. 11.

stated to be visible at the distance of sixty-six miles! The next experiment was, we rather think, made for the first time in public, and consisted of the emission of the electric spark, with a parabolic reflector, and so rapidly continued as to form a perfectly continuous light. This was beautiful; and a magneto-electric light, demonstrating the efficacy of galvanism in producing intensity, was not less so. Coloured lights were also exhibited; and, altogether, a more gratifying display of admirable and useful science never came under our cognizance.*

NEW FACTS, REPORTED TO THE BRITISH ASSOCIATION.

THE following interesting results were reported at the third meeting of the British Association for the Advancement of Science.†

New Law of Combustion.—On Sept. 10, a paper was read before the Chemical Section, by Dr. Charles Williams, On a New Law of Combustion. In this communication the author showed, that many organic substances exhibit, in a dark place, a pale lambent flame, similar to that exhibited by dry phosphorus when heated in the air to a temperature below incandescence, (as low as 300°), and that this flame bursts out into that known to attend ordinary combustion, when the substance is plunged into oxygen gas. This feeble combustion commences in organic substances when vapours begin to be evolved. This feeble flame has little heating power, and passes to ordinary flame by a rapid transition, accompanied by a feeble detonation. Some metals, as zinc and potassium, show the same phenomenon, though of shorter duration, probably from the formation of a coating of oxide.—As a practical result from his observations, he remarked on the danger of many manufactures, as those of soap and candle-making, in which vapours are driven off from organic substances, and this low combustion actually goes on during the whole process of manufacture.

Rutter's Heat Process.—Dr. Daubeny brought before the meeting the economical employment of coal-tar in connexion with water as fuel, according to the method lately suggested by Mr. Rutter.‡ A discussion then arose as to whether the water in this case acts chemically or mechanically, or both, in facilitating the combustion of the tar. Mr. Macintosh stated, that by repeated experiments he had found, that coal-tar gave no more heat when burned than an equal weight of *splint* coal, the kind preferred, where a long continued heat is required. Mr. Low also stated, that from long experience he could affirm, that the use of water along with coal-tar was productive of no benefit whatever, and that 3 gallons, or 33lbs. of coal-tar, give an equal amount of heating effect fully to 40lbs. of coke, made from the Newcastle coal of the Hutton seam. From the discussion on this subject, which was protracted for some time, it appears to be established, 1. That tar may be used as fuel, but that it does not give much more heat than the same weight of the best coal. 2. That when mixed with water, it flows more easily through tubes, but does not appear to evolve more heat than when used alone.

Destructive Distillation.—The next communication was an abstract of

* Literary Gazette, No. 900.

† Reported in Jameson's Journal, No. 34.

‡ See Arcana for 1834, p. 68.

the discoveries of Reichenbach, in regard to the products of the destructive distillation of organic substances. In this paper Dr. Gregory detailed the properties of paraffine, eupion, kreosote, pittakall, picamar, and kapnomor, and exhibited specimens of several of them. He also made some observations regarding the more common products of destructive distillation, and stated that several of these substances are found in the naphtha of Rangoon; the petroline found by Dr. Christison in that substance, being the substance afterwards named paraffin by Reichenback. After a short discussion regarding the products of the distillation of caoutchouc, the meeting adjourned to Thursday the 11th, at 11 A.M.

Sulphur in Iron.—On Sept. 11, Mr. West gave an account of his experiments on bar iron, showing that when dissolved in muriatic acid, sulphureted hydrogen is given off from bar iron of the best quality. He inferred that sulphur is present as a deteriorating substance in most malleable irons; and he suggested that the quantity of sulphur in such irons should be determined more accurately. On the mode of ascertaining this point, some discussion arose.

Water in Sulphate of Zinc.—Mr. Van der Toorn next gave a determination of the amount of water in crystallized sulphate of zinc. The total amounts to 7 atoms, of which 6 are given off at 110° C., the other atom remaining as a necessary constituent of the salt. From this result he concluded that sulphates, which at a red heat give off sulphuric acid, contain an atom of water as an essential constituent. On this subject some discussion arose, and Dr. Clarke stated as a general law, that when salts effloresce, they always form compounds containing a definite number of atoms of water, which compounds may be obtained regularly crystalized by submitting solutions to evaporation at different temperatures.

Chemical Notation.—Some considerations were then submitted by Mr. Johnston on chemical notation, which gave rise to a discussion, in which many members of the section took part. The result was, that the subject of notation was referred to the committee of the section, with the view of introducing into this country a uniform system of notation.

Carbonic Acid.—After which a paper was read by Mr. Henry Hough Watson, on the amount of carbonic acid in the atmosphere of the town of Bolton, and the country around.

His results were in 10,000 parts,

		Max.	Min	Mean.
In the country,	[12 observations] =	4·74	3·89	4·135
In the town,	[19 observations] =	8·62	4·19	5·30

He could not discover any connexion between the variations of its quantity, and season, and weather, as suggested by De Saussure. The method adopted by Mr. Watson to determine the point, did not appear, however, entirely free from objection. In the course of the discussion which arose, Dr. Thomson stated as his opinion, that the difference in the results obtained at different times, and by different experimenters, arose from errors of experiment.

Smelting Iron.—On Sept. 12, Dr. Clark gave an account of Mr. Nixon's process for smelting iron by the acid of the hot-blast, and exhibited numerical results of the advantages derived from the new process. The saving is so great, that the total amount of coal now necessary to produce one ton of iron, amounts only to 2 tons 14 cwt., whereas formerly, it required 8 tons 1½ cwt., being a saving of 5 tons 8 cwt. for each ton of iron produced.

Hydrated Salts.—Mr. Graham gave an account of an investigation

made by him into the constitution of certain hydrated salts. He stated that he had found,—That certain salts of sulphuric acid which crystallize with 5, 6, or 7 atoms of water, contain 4, 5, or 6 of these as water of crystallization, which are expelled at or below 212° under atmospheric pressure, and at 60° in vacuo: That one atom is left as essential to the constitution of the salt: That this remaining atom of water is expelled by a stronger heat, and is in general recovered on exposure of the anhydrous salt to the air; and that in every instance of a sulphate so constituted, the essential atom of water may be displaced by sulphate of potass, which, in the proportion of one atom, occupies the place of the expelled water, constituting a crystallizable sulphate, with a double base and six atoms of water of crystallization. The salts possessing these properties are the sulphates of zinc, iron, nickel, manganese, copper, lime, magnesia, cobalt.

Some applications of these and other facts were made by the author, to the doctrine of Isomerism, which led to a long and interesting discussion between Drs. Dalton, Thomson, Turner, Clark, and Professor Johnston.

Liquefying Gases.—Mr. Kemp gave an account of a paper on a new mode of liquefying the gases, by which they may be obtained more easily, and in much larger quantity. He detailed the properties of several of the gases in the liquid state, illustrating more particularly the independent bleaching power of chlorine, and sulphuretted hydrogen when in a state of liquid, the power of some of the condensed gases as conductors of electricity, and the phenomena resulting where the condensed gases are brought in contact with one another, as well as with other substances.

OXALATE OF CHROME AND POTASH, AND PROTOSULPHATE OF IRON AND MAGNESIA.

M. Gregori finds that double oxalate of chrome and potash, when seen by reflected light, is black; when placed between the eye and the light it is blue; and when powdered it is green: when dissolved in water, the solution in some points of view is green, and in others red. He also finds that the double sulphate of magnesia and protosulphate of iron is of a bright green, and crystallizes in oblique octahedrons. The composition of these salts has not yet been ascertained.*

ECONOMICAL GALVANIC BATTERY.

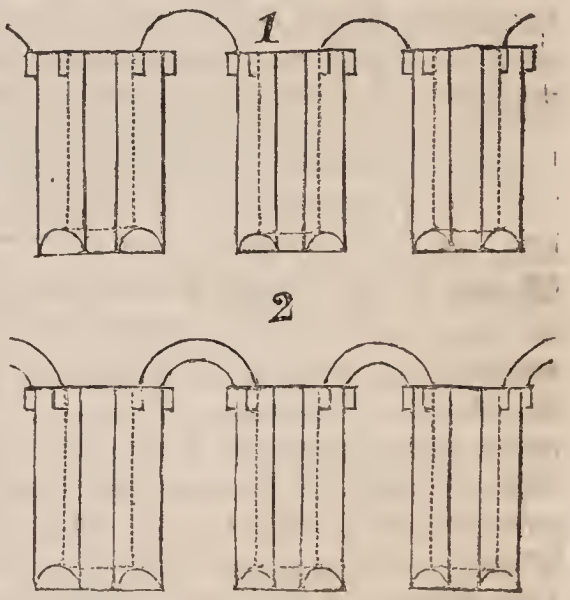
There is hardly any apparatus more acceptable to the experimental philosopher than an effective galvanic battery; but the price usually demanded for these instruments, is such as to keep them out of the hands of all but the wealthier class of experimenters. The following description will enable any person, by the help of an ordinary brazier, to obtain a cheap galvanic battery, adapted to all the purposes for which such an apparatus is required. It is well known that the general applications of galvanism require two modifications of it, usually obtained by two

* Journal de Chimie Médicale, March, 1833.

distinct sets of apparatus. Thus:—either a large quantity of the galvanic fluid is required of feeble intensity, as in Dr. Hare's calorimeter, or in electro-magnetic experiments, for which a single pair of plates, of large dimensions, is used; or else a small quantity of the fluid is required of sensible intensity, as in chemical decompositions, or medical applications of galvanism; for which purpose it is necessary to employ a considerable number of pairs of plates, or alternations of copper and zinc, of small size.

The annexed apparatus is susceptible of either of these modifications, so that it may be converted at pleasure either from a caloric, or electro-magnetic battery, to a chemical one, or the contrary, in a few minutes, and without any soldering or other tedious process.

The copper plates are double cylinders soldered together at the bottom, having between them cylinders of zinc, which are kept from contact with the copper by pieces of wood at the bottom and sides. To each of the zinc cylinders, as well as to each of the outer copper cylinders, are soldered, on opposite sides at the top, a pair of flat copper sockets, into which a thin slip of copper may be inserted for the purpose of connecting the different pairs of plates. The interior of these sockets must be silvered with nitrate of mercury, as must also the extremities of the copper slips which are inserted into them, and should also contain a drop of fluid mercury at the bottom. The copper slips being bent into arches are to be inserted into the flat sockets, as in the sketches, where the dotted lines denote the sections of the zinc cylinders, and the rest those of the copper cylinders.



If a chemical battery be required, insert the slips or arches as in fig. 1, which represents a battery of three pairs of plates—if a calorific or electro-magnetic battery be required, insert the arches as in fig. 2, which evidently represents a battery of a single pair of plates. It is hardly necessary to add, that a variety of combinations may be made out of the same set of cylinders, affording any required modification of the galvanic power as to quantity and intensity.*

PRESENCE OF AZOTE IN SEEDS.

M. Gay-Lussac remarks, that some seeds contain azote is a well known fact, since a substance of an animal nature may be extracted from them, as gluten from wheat flour; but he observes

* Mechanics' Magazine, No. 557.

that he has no where seen it stated that all seeds contain an animalized matter.

To be satisfied that is the case, however, it is requisite only to submit any seed to distillation, either in its natural state, or, what is better, deprived of its ligneous envolope.

Nevertheless, ammoniacal products are not always immediately obtained by distillation. Rice, for example, gives a very acid product; but the presence of ammonia is easily proved by the addition of lime. Kidney beans, and many other similar seeds, give a very ammoniacal product. In general, any grain, deprived of its envelope, may be considered as composed of two parts, one vegetable, which gives an acid product by distillation, and the other animal, yielding ammonia; so that the acid or alkaline character depends upon the predominance of one or other of these matters.

M. Gay-Lussac submitted all grains which came in his way to distillation, and all of them gave ammonia, the greater number immediately, and the others after the addition of lime; and he considers that this circumstance will explain the nutritive quality of grain, and the astonishing fertilizing property of seeds as manure, after the oil has been extracted from them.*

SUPPLY OF WATER FOR THE METROPOLIS.

Mr. Telford's Report to the Lords of the Treasury "on the Means of supplying the Metropolis with pure water," ordered to be printed by the House of Commons, has been circulated among the members. Mr. Telford proposes to supply three of the Water Companies on the north side of the Thames with pure water taken from the river Verulam, about two miles above Watford, in Hertfordshire; and the three Companies on the south side of the Thames with pure water taken from the Croydon branch of the river Wandle, at Beddington Park, in Surrey. The Appendix to this report contains the results of Dr. Bostock's chemical examination of the water from each of these sources, which we now extract, annexing to them the substance of other communications relative to the salubrity of these and other waters, which are also given in the Appendix.

I have examined, Dr. Bostock states, the two specimens of water marked B (from the river Wandle), and C (from the river Verulam): by way of comparison, I made a corresponding set of experiments on the water of the New River.

The water marked B, I found, both in its sensible properties and in its chemical relations, to be of considerable purity. It was perfectly transparent, without colour, taste, or odour, of low specific gravity, and containing only a moderate quantity of saline matter in solution. Its solid contents did not appear to be more than in the proportion of 1·5 grain in 10,000 grains of the water, being somewhat more than the solid

* An. de Chim. et de Phys., May, 1833.

contents of No. 1, of the former specimens [of Thames' water], but not more than the average of the whole of them, while it is less than that of the New River. A small quantity of carbonic acid was discharged from it by boiling, but no perceptible quantity of earthy matter was deposited from it by this process. By the application of the appropriate tests, it was found to contain lime, soda, muriatic acid, carbonic acid, a minute quantity of sulphuric acid, and a trace of magnesia. The quantity of lime was about one grain in the 10,000, being nearly the same quantity as in the New River water, while the muriatic acid is considerably less in quantity.

The water marked C is, in most respects, inferior to B. It was transparent, without colour or odour, but it had a very slight musty flavour (perhaps depending upon the cork), and it contained a few floating particles, to which minute air-bubbles were attached; they appeared to consist of vegetable fibres. It did not affect the test-papers until after it had been boiled, when it indicated the presence of a small quantity of an uncombined alkali, or alkaline earth; it likewise deposited a minute film of white particles. The amount of its solid contents was somewhat greater than that of B, being nearly two grains in the 10,000, almost precisely the same with that of the Thames at Richmond. In contained more lime and muriatic acid than B, and, in addition, it exhibited a trace of potash. It contained rather more lime than the New River, but rather less muriatic acid; it must, therefore, be considered not quite so applicable to domestic purposes. But although it appears from the above examination, that B has a decided preference over C, yet it is necessary to observe, that C is equal, or even superior, in purity, to many waters that are employed for the supply of cities, and could not be considered as objectionable for this purpose.

Dr. Bostock's statement is followed by letters addressed to Mr. Telford by various gentlemen, attesting the good quality of the waters of the rivers Verulam and Wandle, and by a sixth which relates to water from a different source. From three of these, it appears that the water of the Verulam is considered good wholesome water, being used by from one-third to one-fourth of the inhabitants of Watford, for brewing, washing, cooking, making tea, and, indeed, for every domestic purpose, and that it would, in all probability, be more extensively used, were not the upper part of the town well supplied by other means. From the two succeeding letters, we learn that the water of the Wandle is considered suitable for all domestic purposes, being employed for brewing and washing, and in all culinary applications.

The last letter relates to the qualities and applications of water from three several sources used by a family at Harting, in Sussex. These are, a well of some depth, a tank of rain-water, and a small stream which issues from under the South Down chalk-ridge of Sussex, at the distance of a mile, and supplies a mill-pond one-third of a mile distant from the house. "In my opinion," Mr. Telford's correspondent observes, "the most important part of your inquiry relates to tea-making; this foreign plant now furnishing the beverage of all classes, and the use of hard water making a great difference in the strength of the infusion, thus taking money from the pocket of the consumer of the tea, not without also injuring the flavour on his palate." Now at Harting, for the purpose of tea-making, and for personal use, a servant is daily dispatched to the mill, dipping for water below it, which water, therefore, has always been exposed to the influence of the atmosphere while in the mill-pond, where it

deposits a small quantity of chalky matter. The water of the well is used for brewing, and the rain-water (elsewhere so much prized) merely serves for the common purposes of the wash-house, saving the trouble of drawing water from the well. We see, therefore, in this instance, water from a well-known chalky source (not dissimilar, it is remarked, to those of Mr. Telford's north and south streams of intended supply) habitually preferred to rain-water, although the distance of the mill-pond imposes a daily task upon the servants, and while the rain-water pump is at hand in the wash-house.*

PURIFICATION OF CARBONATE OF SODA.

By M. Gay-Lussac.

This salt is commonly purified by repeated crystallization, but it retains so large a quantity of interposed mother liquor that many operations are required to entirely free it from other substances, and after all but a small quantity is obtained. The following process having appeared to me extremely advantageous, I think it may be useful to make it known.

This process is analogous to that which is followed in France for purifying nitre. It is as follows:—Take the crystals of carbonate of soda, such as are met with in shops; having washed them, make a saturated hot solution; when this is set to cool, stir constantly with a rod or spatula to disturb the crystallization and to obtain small crystals resembling sand: the cooling may be accelerated by placing the vessel containing the saline solution in cold water. It sometimes happens that when very much cooled the solution does not crystallize, and that it suddenly becomes solidified. This is the moment to stir very rapidly, to prevent the conglomeration of the crystals. This delay in the crystallization may be prevented by throwing a few crystals into the solution at the moment when it begins to be supersaturated.

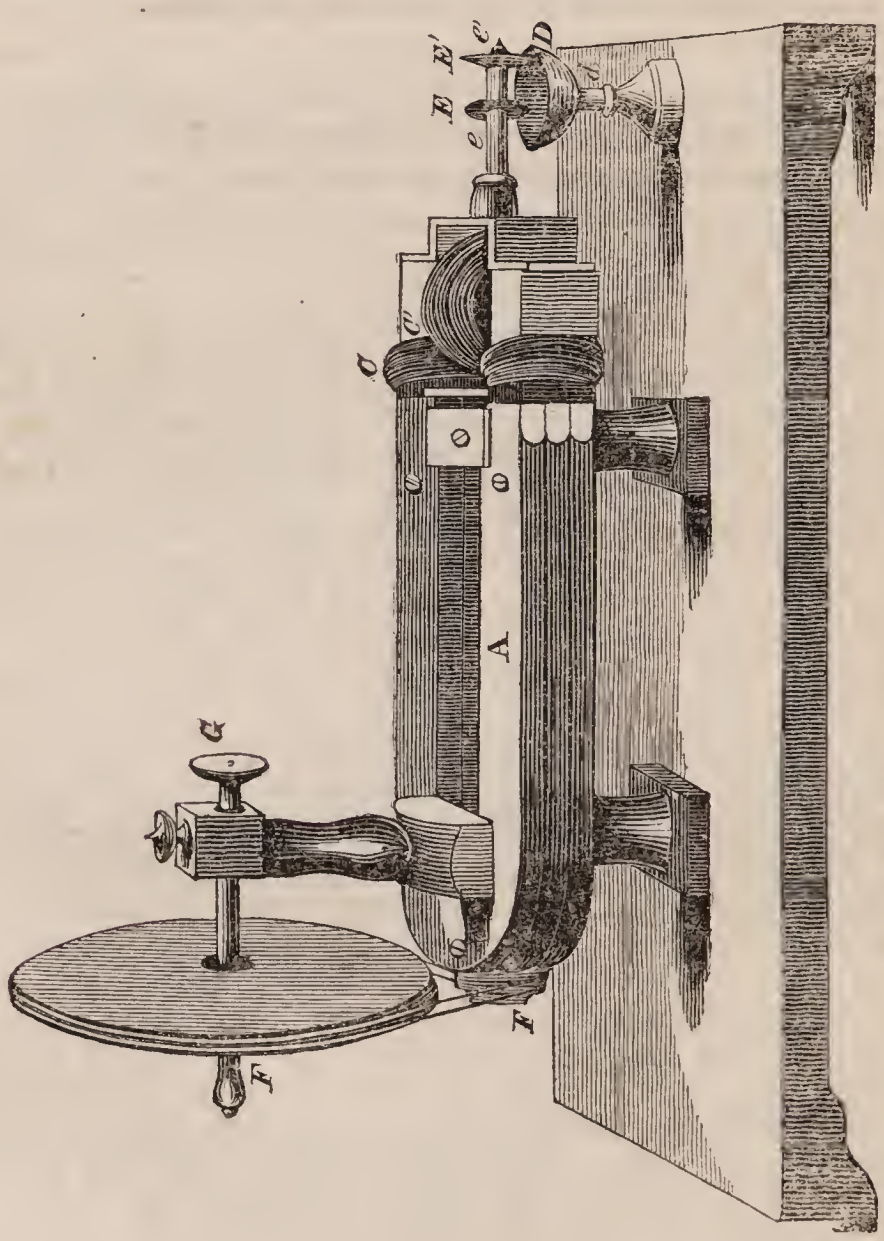
Having obtained the crystals, put them into a funnel, in the neck of which place a little tow or cotton to retain them. At first let them drain, then wash them with small quantities of distilled water, waiting till the preceding washing has run through. Test from time to time the washings with nitrate of silver, the washing being previously saturated with pure nitric acid: the purification of the salt is complete when the liquid remains transparent. By this process, and in the first operation, the greater part of the carbonate of soda employed may be obtained in a perfectly pure state. The mother liquor and the washing may be evaporated and treated in the same manner. The same mode of purifying may be used with advantage for many other salts. Its efficacy is founded upon the extreme facility with which water runs through and well washes sandy crystals, such as are obtained by disturbing the crystallization.†

* Repertory, No. 6.'

† Ann. de Chim. et de Phys., tom. lv., p. 221.

SAXTON'S MAGNETO-ELECTIC APPARATUS.

THE annexed figure of the Magneto-electric apparatus, such as is in operation at the Adelaide-street Gallery, will be useful, especially in illustration of the splendid magneto-electric experiments detailed in the present volume, and its predecessor. The figure is from an apparatus in the possession of Mr. Rutter, by whom a sketch has been forwarded to the *Mechanics' Magazine*, No. 560.



(Saxton's Magneto-Electric Apparatus.)

The magnet in this apparatus is 7 inches long. The space between the poles, from centre to centre, 2 inches.

A, a steel horse-shoe magnet, consisting of three plates screwed together.

B, the armature, or keeper, of soft iron.

C C′ C″, insulated helices of copper wire.

D, a wooden cup for containing mercury, movable by its stem, *d*.

E, a copper disc dipping into mercury, and communicating, by a brass socket, *e*, with one pole of the helices.

E′, a pointed slip, or cross-bar, of copper, in contact, by a central screw, *é*, with the other pole of the helices, and so adjusted, that when the armature is at right angles with the poles of the magnet, the ascending point of the cross-bar shall be about 1-20th of an inch above the surface of the mercury.

F, a grooved wheel fixed upon the axis of the armature, B, to which rapid motion is imparted by the larger grooved wheel and leathern band, F′.

G, a thumb-screw for adjusting the axis of the wheel, F′, so as to tighten or slacken the band.

ACTION OF IODINE UPON STARCH.

By M.M. Leroy, Chevallier, and Lassaigne.

The following observations relative to the mutual action upon each other of iodine and starch, are important relatively to the use of those substances as tests reciprocally of each other's presence, by the blue colour of their combination, the one in the chemical examination of mineral waters, the other in that of vegetable infusions: they are extracted from the London and Edinburgh Philosophical Magazine for March and April, as derived from several foreign journals.

M. Leroy of Brussels, has found that water is requisite to the production of the blue colour which arises from the action of iodine on starch: in alcohol the iodine becomes merely of a dark brown colour, and water causes the blue colour to appear. M. Chevallier has also remarked that farinaceous substances mixed with starch, which are always moist, when subjected to the vapour of iodine, acquired a brown [blue?] colour, while potato starch became of a golden yellow merely. He concluded, from this circumstance, that iodine of starch is of a yellow colour, and that this by absorbing [and combining with] water became blue hydrate; and he found that when this yellow compound was touched with a moistened tube, it became instantly blue.*

M. Lassaigne remarks, that in making some experiments on the combination of iodine with amidine [starch altered by heat] which is easily obtained by gradually pouring an alcoholic solution of iodine into the solution obtained from the starch extracted cold from bruised grain, he found its fine deep indigo blue colour gradually disappear by the action of heat, and at a temperature of about 175° to 195° Fahr. it entirely disappeared, the fluid remaining transparent. It was at first supposed that the iodide of amidine had been decomposed by the heat; but this was not the

* Facts corresponding with those described by M.M. Leroy and Chevallier have been observed by the contributor of these notices of the Progress of Science, in preparing and employing various solutions of iodine and starch as tests.

case, for, on cooling, the blue colour gradually reappeared, and eventually became as dark as at first. This experiment of the alternate destruction and reproduction of colour may be several times repeated, provided the heat be not continued longer than is required to decolourize the liquor; and a few minutes boiling beyond this point destroys the power of reproduction. In this, however, it did not appear that the iodine was volatilized by the vapour of water, as might be supposed; for it is found, in part, in the decolourized liquor in the state of hydriodic acid, mixed with a portion of undecomposed amidine; and the addition of a few drops of a weak solution of chlorine explains why the blue colour is reproduced by this chemical agent.*

CAUTION TO EXPERIMENTERS WITH THE ELECTRICAL KITE.

By Mr. Sturgeon, Woolwich.

On Friday, July, about half-past two in the afternoon, clouds began to form in various quarters of the heavens in rapid succession, from mere specks or streaks to immense groups, with every appearance of being highly electrical.

I repaired to the Artillery Barrack grounds with an electric kite, and in a very short time got it afloat, letting out string through the hands from a coil or clue which was thrown on the ground. When about a hundred yards of the string had been let out, a tremendous discharge took place, which gave me such a blow in the chest and legs that I became completely stunned, let go the string, and consequently the kite soon fell.

The accident was owing entirely to my own neglect, and could not possibly have happened had I taken the following precaution:

Let all the string intended to be employed be first taken off the reel or coil, and stretched on the ground. Let now the insulating cord, riband, glass, or whatever is used for this purpose, be attached to the kite-string and fastened to a peg, tree, or anything intended to hold the kite during the time it is up. Next fasten the kite to the other end of the string, and let it ascend from the hand.

This is the manner in which I usually proceed when heavy clouds are hovering about, and ought always to be attended to, although I neglected it on this occasion. The experimenter by this means is completely out of danger; and he may easily ascertain if the string be highly charged by going to the other end, because of the brushes of light, and noise attending them.

I find it convenient to have a sliding copper wire on the silken cord, which can be moved, by means of a long glass rod, to any required distance from the wired string, the other end being stuck fast in the ground. If the electric fire strikes two inches over the dry silken cord, (and it will sometimes strike a yard), it

* Repertory, No. 5.

would not be safe to approach it; and no man could hold the string when it strikes over one inch of the silk, or, which is the same thing, through the air.

After the electrical state of the string has been ascertained, the wire may be slided away from it as far as possible (the silk ought never to be less than two yards long). The other end is then to be taken out of the ground and attached to the apparatus for experiment. The wire is again slided up to the wired string, and left there during the time the experiments are carrying on.

The only method of getting the kite down during an intense electrization of the string, with safety to the experimenter, is to unfasten the silken cord from its hold and let all go: the kite falls. I have frequently been annoyed, whilst holding the kite-string during hot hazy days when no cloud was visible, by a rapid succession of discharges, from which I had no other means of escape than by quitting the string and letting the kite fall. The same thing sometimes happens in cold dense fogs in the winter. I have experienced these rattling or tremulous shocks when the kite has not been more than 30 yards from the ground, and the wired string at the same time touching it. Hence great quantities of the fluid must necessarily pass into the ground directly through the wire, in addition to that which produced the shocks.

The publication of these particulars may possibly prevent some inexperienced electrician from receiving a death-blow from his kite-string.

Young persons who are fond of kite-flying should also be cautious not to have their kites up during thunder storms, as it is possible that a wet string may transmit a violent discharge, from which a serious accident might occur.*

STRONTIAN.

A MINERAL is found near Nienberg, in the vicinity of Munster, in the Gryphiten chalk-formation, which has been hitherto regarded by some persons in the neighbourhood as moon-stone; but, by a chemical investigation performed by Professor Liebeg, at Giessen, it has been ascertained to be a pure crystalline carbonate of strontian. The pieces are found from one to two feet below the surface, are from three to six pounds in weight, and, from their outward appearance, there can be no doubt that this mineral traverses the chalk-bed in veins of from four to six inches thick, and that it is likewise to be found in other similar formations. It is easily distinguished from the common limestone by its great specific gravity, and the wavy, crystalline, and spongy appearance of the fresh-hewn fragments; the lump is generally rather soft, its prevalent colour a glittering white,

* Philosophical Magazine, No. 28.

which towards the centre becomes grey. The surest method of ascertaining its identity is, by dissolving a piece about the size of a pea, in muriatic acid, and the solution will, upon the addition of spirit of wine, first mix with it and then inflame. The spirit of wine burns, if the substance be really carbonate of strontian, with a bright flame of the colour of carmine. This discovery is due to a clergyman of Nienberg, to whom a peasant brought some pieces found in digging a grave. The announcement is, as it regards the arts and sciences, of much interest; and, as a considerable supply of the substance can now be obtained, it will be of much use to the chemist in many important processes.*

MICROSCOPIC APPEARANCES WITH POLARIZED LIGHT.

By H. F. Talbot, Esq., in the Philosophical Magazine, No. 29.

Among the very numerous attempts which have been made of late years to improve the microscope, I am not aware that it has yet been proposed to illuminate the objects with polarized light. * * * I found it advisable to abandon the use of tourmalines, and to adopt, instead, an arrangement of single-image calcareous spar, the invention of which is due to Mr. Nicol. The effect it produces is entirely similar to that of tourmaline, but it possesses over that mineral the precious advantage of perfect whiteness and transparency. The instrument has nearly the form of a four-sided prism with a romboidal base, and it is conveniently placed in the axis of a small brass tube, which is screwed on as close above the eye-glass as possible, and forms a prolongation of the tube of the microscope. A similar tube is screwed beneath the stage of the microscope, to transmit, and, at the same time, polarize the light of the mirror. This arrangement is found to answer extremely well, for when the two polarizing instruments are placed in a similar position, the field of view is bright and perfectly white; but when the one next the eye is turned round 90°, the field of view is completely dark. It is in the latter situation that the microscope is generally to be used. Having fitted up a microscope in the manner described, let us take for the object of examination a hair. In order to make it perfectly transparent, and to prevent the diffraction of light, it should be immersed in oil, or varnish, and pressed between two plates of glass. The field of view having been darkened as much as possible in the manner before described, the hair is placed upon the stage of the microscope, and it is then seen to be beautifully luminous. As no other light reaches the eye than that which traverses the hair, every minute circumstance in its interior structure is plainly distinguished. It is almost needless to say that this effect is owing to the depolarizing power of the hair. Many organic substances of animal and vegetable origin appear

* Printing Machine, No. 16.

luminous in a similar way, while others, on the contrary, are inert, and have no such action upon light. Fragments of coarsely-powdered sugar, and of various kinds of salts, appear more or less bright, and mottled with various colours; but common salt is an exception, as it remains nearly or altogether dark, at least when it is employed in a state of purity. But when instead of examining amorphous fragments of these salts we view them regularly and carefully chrystallized, the phenomena become much more interesting. Sulphate of copper offers a very excellent example. This salt, which is of a fine blue colour when viewed in considerable thicknesses, is white and transparent when it is extremely thin, and its crystals can be procured so small as to be quite destitute of perceptible coloration. A drop of it was placed upon a warm piece of glass and suffered to evaporate gradually. The crystals shooting from the edge of the drop into the interior of the liquid, had a long and narrow rectangular form, with a slanting extremity, which may be compared in shape to the straight edge of a chisel. Seen by common light these crystals offer nothing peculiar; but on the darkened field of the microscope they are luminous and splendidly coloured, the colour depending upon the thickness of the crystal, and being the same in all points of its surface, except upon the little inclined plane which forms its extremity. But upon this oblique portion are seen three or four distinct bands of colour parallel to the edge, and offering to the eye a visible scale or measure of the rapid diminution of thickness in that part. The observed succession of colours in one experiment was the following. Yellow, brown, purple, blue, sky blue, straw yellow, yellow, reddish purple, blue, sea green, green, greenish yellow, pink, green, pink, blueish green, pink.

REPULSIVE POWER OF HEAT.

By the Rev. Baden Powell, M.A., F.R.S.

The expansion of bodies by heat appearing to imply a mutual repulsion of their particles, it becomes a question whether such repulsive power may not be excited by it between particles or masses of matter, at sensible as well as insensible distances. After noticing the partial investigations of this question by Libri, Fresnel, Saigey, and Professor Forbes, the author describes the method he has employed with a view to its solution, and which consisted in applying heat to two lenses of glass, pressed together so as to exhibit the colours of thin plates; the variation of the tints furnishing exact indications of the most minute changes of distance between the surfaces, by whatever causes they may be produced. The conclusion he deduces from his experiments, conducted on this plan, is that the separation of the surfaces is of a different character, and is greater than can be accounted for

by the mere change of figure produced by the heat; and is therefore in part to be ascribed to a real repulsive action between the surfaces of the glasses derived from the power of heat. He also found, on trying similar experiments with glass in contact with a metallic surface, that the results were considerably influenced by the radiating power of the latter; the effect being increased when this power was greater, and also by all other causes tending to the more rapid communication of heat. This is still more apparent when the coloured rings are formed in a thin plate of water interposed between the lenses, and where the effects are independent of radiation.*

EMPLOYMENT OF FILTERS IN CHEMICAL ANALYSIS.

By Dr. Turner, Professor of Chemistry in the University of London.

In my own researches I am in the habit of determining the weight of substances collected on a filter in one of three different ways. One of these, introduced by Berzelius, consists in burning the filter in a platinum crucible, and deducting the weight of its ashes. This method is peculiarly applicable to the analysis of minerals, where such substances as silica, alumina, and lime are frequent. Even some substances of easy reduction, such as peroxide of iron and sulphate of baryta, may be safely treated in the same way: but in these cases it is advisable not only, as usual, to separate the mass of the precipitate from the filter before setting it on fire, but to moisten both with a little nitric acid, and to ensure very free exposure to the air during the burning of the paper and the subsequent ignition. For such purposes I commonly use some excellent Swedish filtering-paper, kindly procured for me by Berzelius.

Another method is that of the double filter, introduced by Dr. Thomson, which I have used in all the experiments where filtration is spoken of in the present and former communication. Both Berzelius and Dr. Thomson himself seem inclined to doubt the accuracy of this method; and it is certainly liable to objection, except with certain precautions and with very compact filtering-paper. The paper which I use for the double filter is considerably thicker than the Swedish paper, and of such compact texture, that recently precipitated oxalate of lime, or sulphate of baryta, thrown down by Glauber's salt in a neutral solution of the chloride of barium, may be filtered by it. The precautions employed are these:—The paper, folded into filters, is macerated in dilute nitric acid for two days, is then fully washed with warm distilled water, and dried at a temperature of 212° Fahr. After acquiring its hygrometric moisture, two of the filters of nearly the same weight are poised against each other, and any small difference marked in pencil on the lighter one. Before being used,

* Proceedings of the Royal Society, June 5.

a pin-hole is made in the outer filter, in order that any accidental imperfection in the inner filter should be made apparent. After filtration both filters are dried at the same temperature, and are afterwards allowed to recover their hygrometric moisture completely before removal to the balance. In repeated trials I have found a pair of filters to recover, after use, their original relation in weight to within the 100th part of a grain; nor have I ever noticed a greater deviation than may well be expected in every process where filtration is concerned. Additional testimony of the same kind will be found in my Essay printed in the Philosophical Transactions for 1819 [1829], where, in two sets of experiments, the same point is investigated by the use of double filters, and by evaporating the precipitate to dryness without filtration.

A third method consists in employing a single filter, which is dried before and after filtration at some fixed temperature, as at 212° Fahr.; and when so dried is inclosed in a light silver vessel, the cover of which is tightly fitted by grinding. The filter may thus be deliberately weighed without absorbing moisture during the operation. In case of its being inconvenient to employ an uniform temperature, the filter may be dried at a variable heat, be allowed to absorb hygrometric moisture, and afterwards kept at about 60° Fahr. for two hours in a closed bottle, the bottom of which is covered with pulverized quick-lime. In this method, while operating, at least with paper of British manufacture, it is essential, more so than with the double filter, to have previously macerated the filter in dilute acid; for all such paper, which I have examined, contains lime.*

DECOMPOSITION OF GLASS.

The following is an abstract of a notice of some experiments recently made by Dr. Turner, on the action of high-pressure steam on glass and several other substances, which was read before the Geological Society on the 4th of June last. The facts it recites will serve to illustrate the nature of glass, and the circumstances of its decomposition.

An opportunity having presented itself to the author of including substances in a high pressure steam-boiler, he took advantage of it to try the effect which would be produced on glass; and he accordingly encased in wire gauze some specimens of plate and window-glass (the latter being *crown glass*, we presume), and suspended them from the top of the boiler, so that they were surrounded by steam whenever the boiler was in action. They were kept in this situation for four months, during which time the boiler was commonly in action ten hours daily,

* Philosophical Transactions, 1833, Part ii., p. 542.

except Sundays, its temperature being then at 300° Fahrenheit. On opening the boiler at the end of the time specified, all the pieces of glass were found to have been more or less decomposed; and the plate glass in particular, which is a glass of silex and soda, was far advanced in decomposition. Flat pieces, one-fifth of an inch thick, were in some parts decomposed through their whole substance; while in others, a layer of unchanged glass was found in the middle, covered on each side with a stratum of opaque white siliceous earth, having the appearance of chalk.

The author referred these changes to the influence of water on the alkaline matter of the glass. The white earthy portions were found to be entirely free from alkaline matter, which had been dissolved and removed by the water which condensed upon the glass at the successive heating and cooling of the boiler, or which may have been thrown upon it by splashing during ebullition. But the author considered that the actual loss was not due to the extraction of alkaline matter only, but that the silex of the glass had in some measure been dissolved along with the alkali. This was proved to have been the case by the apertures of the gauze envelope being filled up at the most depending parts by a siliceous incrustation, where also a stalactitic deposit of silica, about 1¼ inch long, had formed.

A piece of window-glass (crown glass) included at the same time with the plate-glass, was in a decomposing state, but in a much lower degree. A piece of rock-crystal confined in the boiler at the same time was wholly unchanged.

The author adduced these facts as illustrative of the action of water at high pressures on felspathic and other rocks containing alkaline matters.*

PROFESSOR HARE'S APPARATUS FOR MAKING ICE.

(From the Journal of the College of Pharmacy, Philadelphia.)*

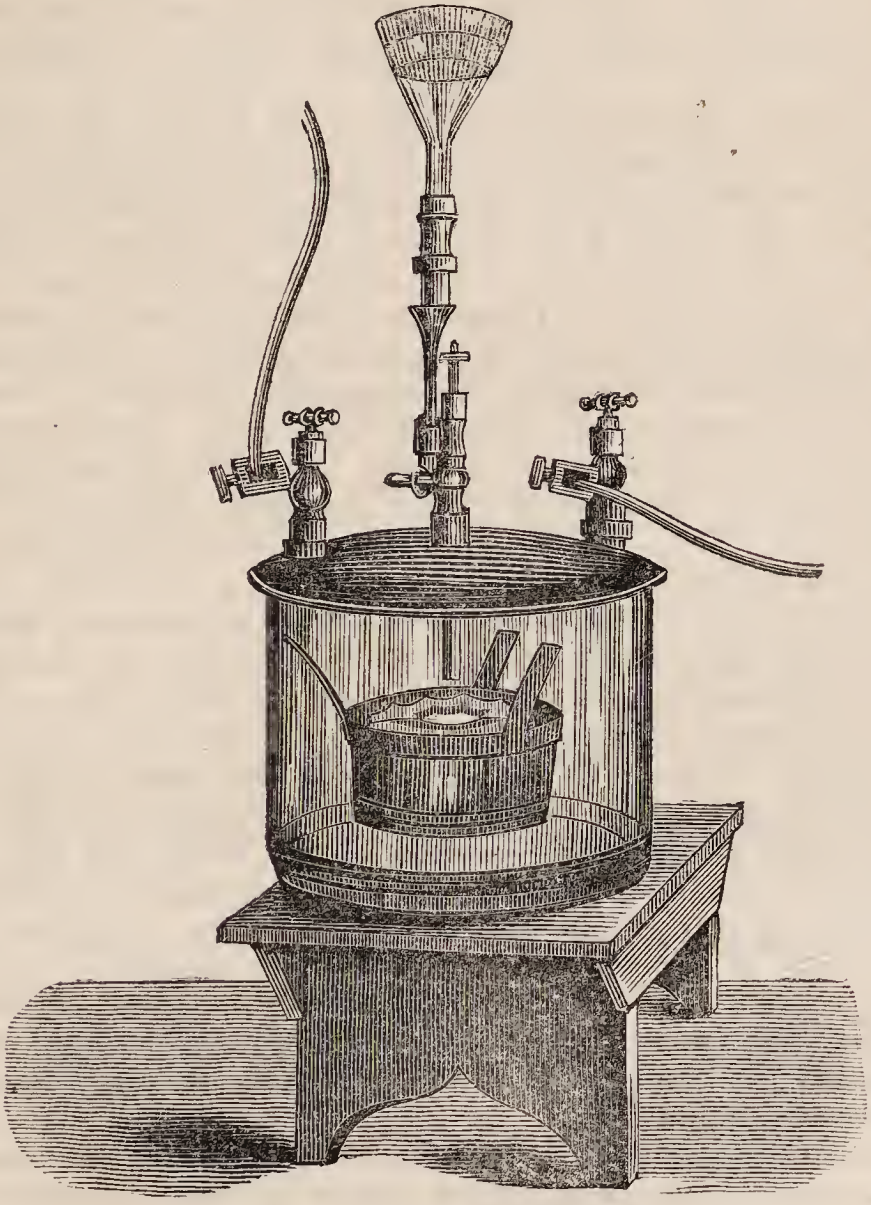
The congelation of water by its own vaporization, accelerated by exposure to the absorbing power of sulphuric acid, or other agents in vacuo, has always been a difficult experiment. A distinguished professor complained to me lately of want of success in his efforts to repeat it. In November, 1832, after having three times succeeded in freezing water by the process in question, yet having failed before my class, I was led to give more than usual attention to the process, in order to obviate the causes of disappointment. It appeared to me that the failure arose from imperfections in the vacuum. An excellent pump, with perfectly air-tight cocks, is indispensable; and not only must the pump be well made, it must likewise be in good order. Neither should

* Proceedings of the Geological Society.

† Quoted in the Mechanics' Magazine, No. 584.

the packing of the pistons, the valves, nor the cocks, allow the slightest leakage. If a pump has been used previously for freezing, by the evaporization of ether, it will not be competent for the experiment in question, unless it be taken apart and cleaned.

Cocks of the ordinary construction are rarely, if ever, perfectly



(Professor Hare's Freezing Apparatus.)

air-tight, and their imperfection always increases with wear. Under these impressions, having cleansed my air-pump, and put it into the best order possible, for the purpose of obviating leakage through the cocks associated with the instrument, I closed the hole in the centre of the air-pump plate by a screw, and for a receiver made use of a bell-glass, with a perforated neck, furnished with a brass cap, and a female screw, by means of which one of my valve cocks was attached. A communication between

the bell and the chambers of my pump, was established through the valve cock and a flexible lead pipe, in a mode analogous to that described in the account of the valve cock, Journ. Frank. Inst., vol. xi., p. 293.* In this way I succeeded in preserving the vacuum, longer than when the cocks of the air-pump were employed in the process; and accomplished the congelation of water by means of the vacuum and sulphuric acid.

Latterly, I have used an apparatus which is represented by the prefixed figure, in which a brass cover is made to close a large glass jar, so as to be quite tight. In operating, the bottom of the jar was covered with sulphuric acid, and another jar with feet, also supplied with acid enough to make a stratum half an inch deep on the bottom, was introduced as represented. The bottom of the vessel last mentioned was, by means of the feet, kept at such a height above the surface of the acid in the outer jar, as not to touch it. Upon the surface of the glass vessel a small piece of very thin sheet brass was placed, made concave in the middle, so as to hold a small quantity of water.

The brass cover was furnished with three valve cocks, one communicating with the air-pump, another with a barometer gauge, and the third with a funnel supplied with water. Under these circumstances, having made a vacuum on a Saturday, I was enabled to freeze water situated on the brass, and to keep up the congelation till the Thursday following. As water in the state of ice evaporates, nearly as fast as when liquid, the whole quantity frozen would have entirely disappeared during the night, but for the assistance of a watchman whom I engaged to supply water at intervals. At a maximum I suppose the mass of ice was at times about two inches square, and from a quarter to half an inch thick. The gradual introduction of the water, by aid of the funnel and valve cock, also of the pipe represented in the figure, by which it was conducted to the cavity in the sheet brass, enabled me to accumulate a much larger mass than I could have procured otherwise. The brass band which embraces the inner jar near the brim, with the three straps proceeding from it, serves to keep this jar in a proper position; that is, in fact, concentric with the outer jar.

In this last-mentioned experiment I employed an air-pump upon a new construction, which I have lately contrived.

ON KREOSOTE, THE ANTI-PUTRESCENT PRINCIPLE OF PYROLIGNEOUS ACID, AND OF WOOD SMOKE.

By M. Reichenbach, of Blansko.

M. Reichenbach, of Blansko, to whose labours we owe the discovery of Paraffine, of Eupione, and Picamore, has recently found in the products of the destructive distillation of wood, a

* Arcana of Science for 1834, p. 140.

new substance, which he terms Kreosote, from the Greek words κρεας *flesh*, genitive by contraction κρεως, and σώζω *I save*.

This substance is highly interesting, not only on account of its chemical properties, but from its useful application to therapeutics, domestic economy, and the preservation of provisions for long voyages. Two processes are given for its preservation. By the one, the Kreosote is obtained from pyroligneous acid; by the other, from the tarry matter which distils over along with that acid. These processes do not differ much; both are tedious, but the latter method seems to be the easier. The tarry matter yields an oil by distillation, to which, after being rectified and heated, carbonate of potash is added, to neutralize the acetic acid associated with it. The acetate of potash separates, and the oil is again distilled, care being taken to reject the first products, and not to carry the distillation to dryness. The oil that comes over is then treated with a solution of caustic potash of sp. gr. 1·12, great heat is produced, and a portion of eupione, &c., formed, which floats on the surface. These are rejected, and the alkaline solution is slowly made to boil in an open vessel. A chemical action takes place,—it absorbs oxygen from the air, and assumes a brown colour. After it is cooled in the open air, diluted sulphuric acid is added until the oil is set free. It is again distilled with water, to which a little caustic potash should be added. The oil is then separated from the water in the receiver, and again treated with a solution of potash, sp. gr. 1·12, boiled as before—cooled—treated with rather an excess of sulphuric acid—poured off from the sulphate of potash—well washed with water to carry off the excess of acid—again distilled with water, to which a little phosphoric acid is added, to saturate the ammonia associated with the oil. Lastly, it is dissolved in caustic potash; and if the preceding operations have been carefully attended to, the kreosote and the potash unite, and the mixture, when heated, leaves no residuum of eupione, nor becomes brown by exposure to the air. The kreosote may then be separated from the potash by distillation, and, although not quite pure, is sufficiently so for medical purposes. The foregoing is a very imperfect outline of the process, which will be seen to be sufficiently tedious. The processes will be found minutely described in the Annals [für Chimie, &c.] of Schweigger-Seidel, vol. vi. and vii.

Kreosote is an oily, colourless, transparent liquid, possessing great refrangibility. Its odour is penetrating, disagreeable, and similar to that of smoked beef. It is of the consistence of oil of almonds, and has a sp. gr. of about 1·037 at 20° Cels. (68° Fahr.) It boils at 203° Cels. (397·4° Fahr.), and is not congealed at a temperature of —27° Cels. (—16·6° Fahr.) It burns with a smoky flame. It is a non-conductor of electricity. At 20° Cels. (68° Fahr.) it forms with water two different combinations, the one containing one-fourth part of kreosote in 100 parts of water, the other, ten parts of water in 100 kreosote.

This substance forms numerous interesting compounds with acids and alkalies. Concentrated, it dissolves the deutoxide of copper, and assumes a chocolate brown colour. At a boiling heat it reduces the deutoxide of mercury, and is then transformed into a resin, which has no longer the properties of kreosote. Nitric acid acts on it strongly, and acid vapours are disengaged. It combines with chlorine, bromine, iodine, phosphorous, and sulphur. Potassium thrown into it disappears, gas is disengaged, and potash remains combined with thickened kreosote. From this combination the kreosote separates by distillation. Concentrated sulphuric acid added in small quantities, gives to kreosote a reddish

colour; but when the quantity of acid is increased, the kreosote becomes black. Of all the organic acids, the acetic seems to have the greatest affinity for kreosote, uniting with it in every proportion.

This substance, when cold, forms two combinations with potash. The one is an anhydrous liquid, of an oily consistence; the other is a hydrate, and cryatallizes in white scales. All the acids, not excepting carbonic acid, separate the kreosote from these combinations. With soda it forms combinations similar to those with potash. It has a great affinity for lime and the hydrate of barytes; with these bodies it forms compounds of a dirty-white colour, soluble in water, but which, when dried, assume the appearance of a rose-coloured powder.

Kreosote, in a warm and cold state, dissolves a great number of salts; some are reduced, but the greater part are separated in the form of crystals by cooling, such as the acetates of potash, soda, ammonia, lead, and zinc, and the hydrochlorates of lime and tin. It reduces the acetate and nitrate of silver.

Alcohol, ether, acetic ether, carburet of sulphur, eupione, and oil of petroleum, combine with kreosote in every proportion. Paraffine, though issuing from the same source with kreosote, has little tendency to combine with it. Indeed, the combination cannot be effected, unless eupione be present, and is in a direct ratio to the quantity of eupione. Kreosote with difficulty dissolves caoutchouc, and only by the assistance of boiling, differing very much in this respect from eupione, which readily dissolves caoutchouc.

If to a solution of albumen in a large quantity of water, a single drop of kreosote be added, the albumen is immediately coagulated. When fresh meat is put into a solution of kreosote, allowed to remain for half an hour or an hour, then withdrawn, and afterwards dried, it may be exposed to the heat of the sun without putrefying, and in the space of eight days it becomes hard, the colour changes to a reddish brown, and the flavour is that of good smoked beef. Fish may likewise be preserved by it. It is pretty evident that kreosote is the antiputrescent principle of pyroligneous acid and of wood smoke.

M. Reichenbach has ascertained that kreosote does not act upon pure fibrin, which, by itself, is said not to be susceptible of putrefaction. Its action upon the animal economy is deleterious. Placed upon the tongue it occasions violent pain; and when poured in a concentrated state upon the skin, it destroys the epidermis. Insects and fish thrown into it immediately die. Plants also perish when watered with it. M. Reichenbach has made experiments with this substance, concentrated and diluted, and his success has surpassed his expectations. It has, he alleges, effected a speedy cure in cases of caries, of cancer, and of carcinomatous ulcers.

M. Schweigger-Seidel has made a comparative examination of kreosote, and the aqua Binelli, from which he has come to the conclusion, that the fundamental base of this hemostatic liquor is kreosote, of which it is only an excessively weak solution.*

DRY-ROT.

A NOTICE of the discovery of an undoubted prevention of dry-rot in ships and buildings, formed the subject of a late lecture by Mr. Faraday, at the Royal Institution.

* Edinburgh Medical and Surgical Journal.

Mr. Faraday exhibited to his audience several specimens of wood affected by the dry-rot, and a piece of dry-rot fungus from the conservatory of the Duke of Norfolk, which had prospered so much, that even its fructification was fully developed. Another specimen from Brighton Pier was also exhibited, and part of a ship's mast, which, though sound on the outside to all appearance, was hollowed within as if it had been done by the tool of a workman.

With respect to the dry-rot in ships, the learned Professor said, that he had himself gone on board his Majesty's frigate Thalia, to see the state of her timbers, and that a reference to one or two cases of decay in such vessels, would exhibit facts most extraordinary, taking into calculation the enormous expense incurred from the operation of dry-rot. A first-rate, carrying 90 guns or upwards, consumed, in her construction, 5,880 loads of timber; a second-rate, or 80 gun ship, consumed 4,839 loads; a third-rate, 3,600 loads; a fourth-rate, 2,732 loads; a fifth-rate, 1,800 loads; and a sixth-rate, 963 loads. The statements which appeared in the *Quarterly Review*, some of which he would read, would give those who had not attended to the subject some idea of the importance of the present inquiry.

The Rodney was launched in 1809; she had scarcely put to sea, when, owing to the unseasoned state of her timbers, all her fastenings became loose; and it was found necessary to bring her home from the Mediterranean in 1812, to be paid off. The next example was that of the Dublin, launched in February, 1812, commissioned in August, sent upon a cruise in December, from which she returned in 1813—one year from the time of her being launched, when she was repaired at an expense of 20,000*l.*

The Queen Charlotte was built in 1810, and broken up in 1811; and of three other ships, the St. Domingo, Blake, and Florida, not one lasted more than five years. In 1814, fifteen frigates were built of Canada red pine, and three frigates of Canada white pine, which lasted on the average three years and a half.

In building and repairing ships, docks, and buildings belonging to the King's naval service of Great Britain, there was expended, in ten years, from 1823 to 1833 inclusive, 8,432,044*l.* 7*s.* 4*d.*—the existing navy, comprising an aggregate amount of 1,216,719 loads of timber, which, valued at 6*l.* per load, represents a capital of 7,300,314 pounds sterling.

This statement is submitted in order to give the reader an idea of the magnitude of the saving to be effected in one branch of the national expenditure, by the introduction of a preventive of the dry-rot; to the devastating qualities of which is attributable the enormous charge upon the vast capital under the head of "wear and tear."

We now come to the discovery. A gentleman of the name of Kyan, considering the well known anti-destructive qualities of

corrosive sublimate, proposed to apply that active body to timber, in order to secure it from the attacks of the formidable disease to which it has hitherto been liable, arising either from the action of the seeds of cryptogamous plants vegetating in the wood, or from the presence of the albuminous parts of the tree —he thought the evil might be stopped, that the commencement even might be prevented, by the application of corrosive sublimate, in consequence of the chemical combination which takes place between the corrosive sublimate and those albuminous particles which Berzelius, and others of the highest authority, consider to exist in and form the essence of wood; which being the first parts to run to decay, cause others to decay with them.

Mr. Kyan was so confident of success, that he submitted his proposition to the Lords of the Admiralty, who, in the first instance, required trials to be made, in order to prove the value of the application. These trials were made; and, at the end of two or three years, their lordships advised Mr. Kyan to take out a patent, which he did.

Of these trials so required by the Admiralty, and their results, it is now necessary to say a few words. The process is in itself exceedingly simple. The timber is immersed in a solution of the corrosive sublimate, which is pumped into a tank, in which the timber is held down by transverse beams, so as to prevent its floating; and, after submersion for a week, the operation is completed.

Dr. Faraday exhibited to his auditors some of the pieces submitted to trial by the Lords of the Admiralty three years before, in the fungus-pit at Woolwich—a pit dug in the yard, and inclosed on all sides by wood, having a double wooden cover. It was damp of itself; and into this were put the various kinds of wood of which they wished to make trial. One specimen was a piece of timber which came out, at the end of the three years, as sound as it went in, while the unprepared part had decayed up to the very point. No portion of it had been left; it had decayed and become rotten throughout; but the other piece was left whole and sound, and fit for the construction of vessels.

A large cube of wood, which had been there, in the first instance, for three years,—found sound at the end of that period, and returned to the pit for two years more, making altogether five years,—was taken out on the 19th of February last, perfectly hard and sound. There was no sign of decay in that wood, which had been submitted to the rotting action for five years, nor of that destruction which seems to have come on so soon in the same pit with other pieces of wood.

Sir Robert Smirke had a couple of posts put up under a dripping eave, and both were exposed to the same action. After a certain time, one of them decayed: the other still stands, having been preserved by the power of this substance. Similar

effects were exhibited of its efficacy upon other substances—rope, canvass, and cotton. Several specimens of these articles were shown, which had been purposely exposed to damp in a cellar from the 10th of December, 1832, and left until the 21st of February, 1833—a prepared piece and an unprepared one, which had been coiled up in a cellar from the 15th of December, 1832, to the 21st of February, 1833; and the opposite effects were produced by the same circumstances on exposure, upon prepared and unprepared calico; one was as it went in; but the other was the calico corresponding to it which had rotted and decayed; it was not possible to unfold without destroying it, yet it had been similarly exposed with the first.

Mr. Faraday proceeded to detail a number of experiments which he had made, with a view to discover whether the effects of the corrosive sublimate might be injurious, and which had the effect of satisfying him that it could not be so; and as far as these experiments went, to strengthen his opinion as to its efficacy as a preventive of dry-rot, he says, that he is of opinion that the process would be effectual; and added, "I think the improvement so great, as fully to justify its extensive application."

In conclusion, the learned Professor observed, that if the hopes which the process afforded were fully borne out, its employment must have such extensive application as mightily to improve the great subjects to which it may be applied, and the trade connected with them. He was inclined to think it would be found useful in a far higher degree in the construction of cottages and out-houses, than palaces; for it is of far more importance to those whose means were small, that they should have that duration given to their timber which would extend the application of their means, and give permanency to their comforts.

The experience of five years affords ample security for the success of the discovery. The trials have completely satisfied the minds of all who have interested themselves in the question; and we believe, unless circumstances of a political character had not occurred to break up the ministry, the final decision of government as to its adoption might soon have been expected. At present, the process has been adopted with the timber used in building the addition to the Temple, King's College, Clerkenwell Church, Westminster House of Correction, and Fishmongers' Hall; the National Gallery, the new works at the British Museum, and the warehouses of the East India Company; and several churches in town and country. The London Dock Company have also adopted it, and many engineers connected with the Liverpool, Manchester, and Stanhope, Tyre, and Wear rail-ways, in lieu of stone sleepers.*

* Literary Gazette, No. 908.

IMPROVEMENTS IN DISTILLATION.

Mr. Joseph Shee, of the city of London, has patented the following invention of a peculiar arrangement of apparatus for distillation, as shown in the annexed engraving; the details of which are—

In fig. 1, *a*, is an ordinary still. *b*, is a second still, connected to the still, *a*, in such manner that the vapours rising therefrom shall pass through the lower part of the still, *b*, and give off heat to the fluid contained therein; and this is preferable to accomplish by means of tubes passing through the still, *b*. These tubes open into the box, *l*, into which the vapours of the still, *a*, flow, and thence pass through the tubes contained in the still, *b*; and thereby evaporate the fluid contained in this still. *c*, is a third still; and *m*, is a trunk or box communicating from the tubes contained in the still, *b*, to a like series of tubes contained in the still, *c*, so that the vapours from the still, *a*, having passed through the tubes in the still, *b*, next pass through the tubes in the still, *c*, and likewise heat the fluid contained in this third still, and cause it to be evaporated: but this effect is further advanced by the vapours which are raised in the still, *b*, being also passed through the still, *c*, by means of a series of tubes contained in the still, *c*; and this is accomplished by the beak, *n*, of this still passing into a box at the back of the still, *c*, into which the tubes open: but it should be here remarked, that the products or vapours of the still, *a*, and the still, *b*, do not mix with each other, nor do the contents or vapours of any one still mix with that which is in another still. *d*, is a fourth still, having a like series of tubes to those described to the stills, *b* and *c*, there being a box, *o*, opening from the tubes through which the vapours from the still, *a*, are conveyed through the still, *b*, so that those vapours are conveyed through the still, *d*, as well as through the stills, *b* and *c*; and thence by the pipe, *p*, into a series of pipes contained in the vat or vessel, *x*, (which contains wash which becomes heated before passing into the still, *a*,) and thence into the worm-tub, *q*, and is there condensed and passed off to the receiver, *r*. The vapours which are raised in the still, *b*, have already been stated to pass by a series of tubes through the still, *c*; from thence, by means of the trunk or box, *e*, they pass through a series of tubes contained in the still, *d*, and thence by means of the pipe, *f*, they pass through the worm-tub and become condensed and flow into the receiver, *s*. The vapours which are raised in the still, *c*, are conveyed into the box, *g*, and thence through a series of tubes contained in still, *d*, from whence they pass, by the pipe, *h*, through the worm-tub, and flow into the receiver, *t*; and the vapours from the still, *d*, pass immediately through the worm-tub and into the receiver, *u*. Each of the stills, *a*, *b*, *c*, and *d*, have a pipe, *v*, descending from the bottom. On each of these pipes, *v*, there is a stop-cock, and the object of these pipes is to draw off the residue, if any, after every operation, which residue flows into the pipe, *w*, by which it may be conveyed back into the still, *a*, there to be again distilled with the next charge of wash, or it may be conveyed into any receiver till there is sufficient to form a charge of itself. According to the arrangement shown in the engraving, it is conveyed into the still, *a*, that is, into the first still of the series. A, is a pipe ascending from the receiver, *r*, into a tank or vessel, B, which is situated above the still, *b*; and C, is a pipe (having a stop-cock) descending from the vessel, B, into the still, *b*, to supply that

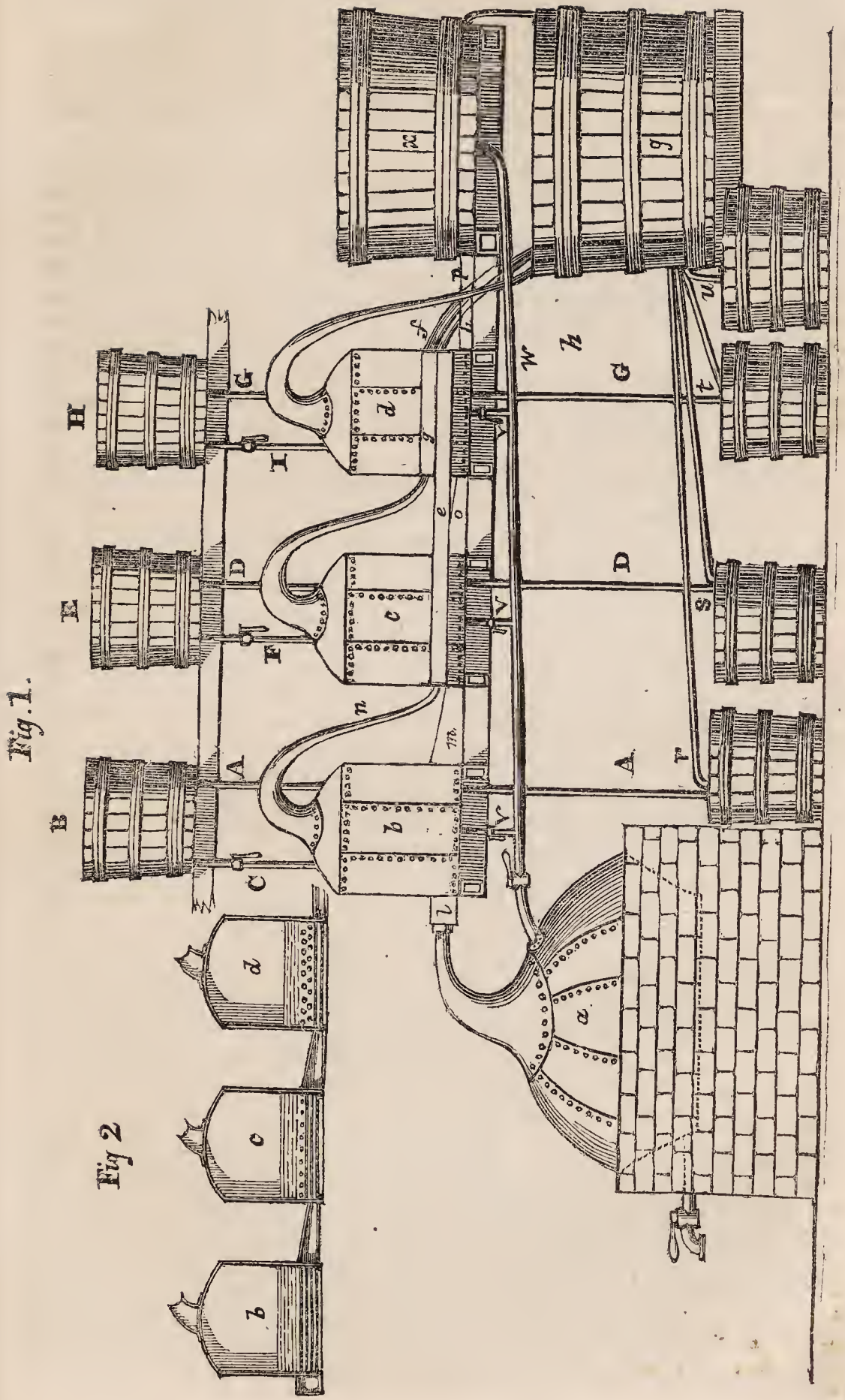


Fig. 1.
Fig 2
(Shee's Patent Still.)

still with the product which has been distilled over from the still, *a*, and pumped up from the receiver, *r*, as will be hereafter fully described. D, is a pipe rising from the receiver, *s*, into the vessel or tank, E, placed above the still, *c*, there being a descending pipe, F, therefrom (having a stop-cock), by which the still, *c*, is supplied with the product of the still, *b*, pumped up from the receiver, *s*. G, is a pipe ascending from the receiver, *t*, into the tank or vessel, H, which is placed above the still, *d*, there being a descending pipe, I, (having a stop-cock), by which the product of the still, *c*, is supplied to the still, *d*, after being raised from the receiver, *t*, as will be fully described in the manner of carrying the process of distillation with this apparatus. It has not been thought necessary to show in the drawing the various pumps and apparatus for working the same, which will be required for raising the products of the stills from the receivers, *r*, *s*, *t*, into the tanks or vessels, B, E, H, they forming no part of the invention, and will be readily applied by any person competent to perform the other part of the work. It is not essentially necessary that the parts of the apparatus above described should be arranged precisely as shown in the drawing, but may be varied to suit circumstances. In order to the clear understanding of the arrangements of tubes, I have, in fig. 2, shown the stills in section, an inspection of which will render the same most evident. In the drawing are shown the worms attached to the various pipes leading from the four stills as being contained in one worm-tub or vessel, but it is evident that the same may have separate worm-tubs to each still.

To describe the process of operation, suppose the still, *a*, is capable of receiving 800 gallons of wash, and that the same will distil over 300 gallons of products; by the time the wash in the still, *a*, becomes spent this 300 gallons pass off in the form of vapour at the beak-head, through the series of tubes for that purpose contained in the stills *b*, *c*, *d*, thence through the preparing-vat, and thence to the worm-tub, and then into the receiver, *r*. This product is to be raised into the vessel, B, either continually during the process, or otherwise, provided it be ready for changing the still, *b*, when the still, *a*, has been worked off. The spent wash is next to be run off from the still, *a*, and a fresh charge of wash supplied from the preparing-vat, and the cock on the pipe, C, is to be opened, and thereby supply the product of the former distillation from the still, *a*, into the still, *b*; the cock is again to be closed, and the process will proceed. The vapours will again be distilled over from the still, *a*, and pass through the various stills, as above described, and be received condensed in the receiver, *r*; but in this instance the former product will be again distilled over from the still, *b*, by the heat of the vapours from the still, *a*, and the product of this distillation will pass through the respective series of tubes contained in the stills, *c* and *d*, and through the worm-tub, and into the receiver, *s*, and from thence is conveyed, as above described, into the vessel, E. The second charge of the still, *a*, being now distilled over, and received in the receiver, *r*, the spent wash is to be run off and the residuum from the still, *b*, permitted to run into the still, *a*, as above described, by means of the cock on the pipe forming part of the third charge to the still, *a*. The cock is then closed, and the product of the second charge to the still, *a*, is then to be run into the still, *b*, and in the meanwhile the products of the first charge of the still, *a*, which has now been re-distilled by the still, *b*, is to be permitted to flow into the still, *c*, by means of the cock on the pipe, F, which is afterwards to be closed, and the process goes forward: the third charge in the still, *a*, is

distilled over as above described, as is also the charge in the still, *b*, the vapours from *a* and *b* heating in their progress the still, *c*, and distilling over its contents; the products of each of these stills being received into their respective receivers, and conveyed into their respective tanks or vessels above, in order to supply the stills in the order above described. The spent wash is to be run off from the still, *a*; the residuum contained in the stills *b* and *c*, run into the still, *a*, to form part of the fourth charge. The stills, *b*, *c*, and *d*, are to be charged from their respective tanks or vessels; by this means the product which was obtained from the first charge of the still, *a*, will have arrived at the still, *d*; the process then goes on, and by the distilling over the fourth charge from the still, *a*, the stills, *b*, *c*, and *d*, will also distil over the charges respectively contained. By this last operation the product obtained from the first charge of wash will have passed through the whole process and be received into the receiver, *u*. Thus is the process to be continually carried on, the products proceeding one stage in the process at the working off of each charge of the still, *a*, and by the same heat which is requisite under ordinary circumstances for the mere purpose of distilling over the contents of that still.

In the above apparatus, the inventer claims the method or process of carrying on the process of re-distillation through a series of stills working simultaneously, and by the same heat as is used to work off the first still, and whereby the product is advanced one stage of the necessary process at each charging of the said first still, as above described, and whereby the products are kept distinct.*

NEW ANALYSES OF CORROSIVE SUBLIMATE AND CALOMEL.

By Dr. Turner.

Bichloride of Mercury.—The corrosive sublimate of commerce was purified by repeated crystallization from distilled water, and was then well dried at its subliming temperature. It might in that state be sublimed without giving any trace of humidity. Of this chloride 137·595 grains were dissolved in warm water, and directly decomposed by nitrate of silver; and the chloride of silver was washed with water acidulated with nitric acid, and amounted in the fused state to 144·374 grains, equivalent to 35·659 of chlorine. The bichloride of mercury would hence seem to be composed of

Mercury	101·936....	201
Chlorine	35·659....	70·31

giving 35·16 as the equivalent of chlorine. This result led me to suspect some imperfection in the method of analysis; and I accordingly found that some of the bichloride of mercury is apt to combine with the chloride of silver, and being expelled when the latter is fused, a loss of chlorine is occasioned. To avoid this error, the bichloride was decomposed by lime, which was prepared from Carrara marble, and was quite free from muriatic

* Repertory, No. 12.

acid. The requisite quantity of lime, previously slaked, was mixed with a little warm water, and the solution of a known weight of corrosive sublimate gradually added, shaking the mixture after each addition. After a short digestion and filtration, the liquid was neutralized by nitric acid, and the chlorine determined by nitrate of silver in the usual manner. Every trace of muriatic acid may thus, without the necessity of boiling the materials together, be transferred to the lime and rendered soluble, while the oxide of mercury, of an orange colour, is left with the excess of lime. In this way I obtained the three following ratios:—

	1.	2.	3.
Mercury	113·441..201	113·149..201	112·535..201
Chlorine	39·748.. 70·428	39·723.. 70·565	39·433.. 70·43

According to these results we obtain 35·214, 35·28, 35·26 as the equivalent of chlorine.

Calomel.—The proto-chloride, though much more stable than the protoxide of mercury, is very subject to change. I believe it is impossible to sublime calomel without a portion being resolved into mercury and corrosive sublimate; and after washing calomel, so as to remove the adhering bichloride, the heat subsequently required for rendering it quite dry causes a fresh production of corrosive sublimate. I selected for analysis the pulverulent white calomel prepared by Mr. Howard, and dried it by exposure to a continued heat of 300° Fahr., at which temperature it undergoes no appreciable decomposition, and contains only a trace of moisture. But that trace of humidity affects the ensuing results with a small error, the tendency of which is to make the equivalent of chlorine smaller than it is. The following are the ratios of three careful analyses, which were made by means of lime, as in the analysis of corrosive sublimate.

	1.	2.	3.
Mercury	100·048..201	95·154..201	76·565..201
Chlorine	17·602.. 35·361	16·721.. 35·32	13·473.. 35·37.*

PLUMBER'S COLIC.

M. Roard, the director of a white lead manufactory in France, has introduced the use of sulphuretted lemonade among his workmen, and the lead colic has in consequence disappeared from his establishment. In two months but four workmen have experienced slight attacks of the disease, and these exceptions are accounted for by peculiar circumstances, which might have been avoided. The subsequent results have been verified in respect to the colic. Six workmen, among whom are three of those

* Philosophical Transactions, 1833, Part ii., p. 533.

already mentioned, have experinced sensations unusual to the organs of the stomach, which had hitherto been supposed to be attendants upon the colic, such as cramps, or nervous epileptic symptoms, besides weakness of the muscles. These casual effects were produced by a coating of oxide and carbonate of lead upon the cuticle. This will account for many affections incidental to plumbers and painters, which it has not heretofore been easy to explain; it points out the cause of the relapses and symptoms which are so often exhibited, after the colic has been cured, in the case of workmen who are habitually exposed to the virulent exciting causes of the malady. Whether we consider the sulphuretted acid to act as a preventive or cure, it must be applied not only internally but also externally. M. Roard's men, therefore, use the lemonade both as a beverage and as a lotion.*

CALICO AND SILK PRINTING.

In May, at the Royal Institution, after some introductory observations on the nature of ornament and contrast of colour, illustrated by an ingenious diagram by Mr. Brockedon, Mr. Cowper explained the various modes of printing silks and calico from engraved wooden blocks, copper-plates, curved copper-plates invented by Applegath, copper cylinders, wooden cylinders curved with pins engraved so as to print from the surface, and the mode of producing a pattern on the cloth by discharging the colour, or by printing it with a protecting wax, which prevents the dye from staining the parts so printed. He also illustrated what is technically called tie-work; which consists in pinching up the cloth with the finger and thumb, and tying it round with a piece of thread. When a handkerchief so tied is put into the dye-vat, the colour cannot reach the tied part, but leaves a little white square spot, with a small coloured one in the middle, which is a very common pattern in silk handkerchiefs. The materials printed in the cloth by the blocks or plates, are either the actual colour wanted, or *mordants*, *i.e.* preparations to receive the colour from the dye-vat; the actual colours are called chemical colours, and are fixed in the cloth by steaming, after it is printed. The two principal mordants are acetate alumine and acetate of iron. If a piece of cloth be printed with seven different blocks, and we use acetate of iron with one block, three different solutions of acetate alumine with three others, and three different mixtures of it with acetate of iron with the remaining three blocks, and, after drying and washing, put the cloth into the copper with madder—the madder will raise a black when the iron is printed, three shades of red when the alumine, three shades of lilac or chocolate when the mixture is used. The

* From a Paper read before the Paris Academy of the Arts and Sciences.

mordants have a strong affinity to the cloth, and the dyes a strong affinity to the mordants. Colours so produced are "fast colours;" whereas chemical colours will not bear much washing. Mr. C. showed the curious operation of cleansing the superfluous colour off the copper-plate after the colour had been rubbed into the crevices of the engraving. It is in fact scraped off by a thin flexible piece of steel, called by calico-printers "doctor steel," or "the doctor." Some persons, thinking this an absurd name, call it "ductor," which is, perhaps, not much better. Mr. Faraday suggested that this might be a corruption of *abductor*—"the taker away,"—which is exactly its office, and no doubt its proper name, although it is called doctor by every calico-printer in the kingdom.*

RAPID SKETCH OF THE PRESENT STATE OF ELECTRICITY.

Professor A. De La Rive has published, in four successive numbers of the *Bibliotheque Universelle*, for the year past, an able historical view of the principal discoveries made in electricity within the last few years. His memoir concludes with the following *résumé*.

In terminating this historical sketch which we have endeavoured to render as complete as possible, it will not perhaps be deemed amiss if we present, in a few words, the state in which it leaves the science of electricity.

1st. Two different principles are acknowledged to exist in electricity; the laws of action to which these principles give rise have been determined, both when they are isolated and at rest, and when they are in motion in order to unite. But the nature of them has not yet been determined: nothing has yet been done but to advance hypotheses which are still unsatisfactory,—such especially as that which regards them as very subtle fluids, endowed with certain distinct properties. It is probable that they are rather, both of them, different modifications of the ethereal matter which fills the universe, and whose vibrations constitute light; modifications, the nature of which cannot be known until the most intimate properties of electricity have been more thoroughly studied and ascertained.

2nd. It has been successfully determined that magnetism is only the result of natural electric currents. But what is the disposition of these currents in magnetized bodies? What is the cause which gives rise to them, and what is the reason that a very small number of bodies only is susceptible of the magnetic virtue? These are questions which cannot yet be answered.

3rd. All the sources of electricity are probably at present known; but with respect to the laws which, in each case govern its developement, we are still very far from having discovered them.

* Literary Gazette, No. 609.

4th. The influence which bodies may exert over electricity, either when placed in its track, or interposed between it and the points towards which its exterior action is directed, has been within a short time past, studied with great care. Many curious phenomena, in relation to this influence, have been discovered; some laws even have been settled: but the number of anomalies and unexplained effects is still very considerable. It is probable that in the investigation of this class of facts, means may be found of arriving at some notions with respect to the nature of electricity, and the relations which connect this agent with ponderable matter.

5th. The effects which electricity produces on bodies are now well known; the laws to which they are subjected, are in general well determined; but their connexion with the cause which produces them rests only on hypotheses, which can boast but very little solidity, and which have lately been very much shaken. It is by an inquiry into this connexion by a study in detail of those effects, that we are to find the means of arriving at a more just idea of the nature of electricity, and of the cause of the effects to which it evidently gives rise, as well as which are perhaps erroneously ascribed to it, and which, such as chemical phenomena, have probably no other relation to it but that of being occasioned by the operation of the same agent.

6th. Finally, after having, from its very origin, framed and demolished theories to account for the action of the Voltaic pile, philosophers are not yet united on that subject, and although at the present time, the chemical theory of this admirable apparatus may perhaps be most in vogue, it still requires the support of further observation to be generally adopted, and definitely substituted for the electromotive theory of Volta, the unsatisfactory nature of which is now fairly demonstrated.

This brief recapitulation is sufficient to show that, notwithstanding the importance of the discoveries with which electricity has been enriched, that which remains to be done in this part of physical science, is perhaps more considerable than all that has hitherto been done, since almost all its laws and all its principles are still to be discovered.*

ON THE QUANTITY OF SOLID MATTER SUSPENDED IN THE WATER OF THE RHINE.

By Leonard Horner, Esq. F.G.S., F.R.S.

A PAPER on this subject, of which the following is the official abstract, was read before the Geological Society on the 26th of February last. We transfer it to our pages because the subject of the quantity of solid matter transported by rivers, is one which

* Silliman's Journal, No. 53.

is daily rising in importance, both in a practical and in a philosophical point of view.

The experiments referred to in this paper, were made by the author at Bonn, in the months of August and November. The apparatus which he used was a stone bottle capable of containing about a gallon, and furnished with a cork covered with greased leather, having a long string attached to it. A weight was suspended from the bottle by a rope of such a length, that when the weight touched the ground, the mouth of the bottle was at the desired distance from the bottom of the river. The cork was then removed by the string, and the instant the bottle was full it was drawn up.

The first set of experiments was made in August, at 165 feet from the left bank of the river, and at 7 feet from the surface, or 6 feet from the bottom. The Rhine was unusually low, and the water was turbid and of a yellowish colour. The quantity of solid matter obtained from a cubic foot of water, and slowly dried, was 21·10 grains, or about $\frac{1}{20,734}$th part. The residium effervesced briskly with diluted muriatic acid, was of a pale yellowish brown colour, smooth to the touch, and in appearance and properties undistinguishable from the loess of the Rhine valley.

The second set of experiments was made in November on water taken from the middle of the river, and about one foot below the surface. A great deal of rain had fallen some time before, and also fell during the experiment. The water was of a deeper yellow than on the former occasion, but when taken up in a glass was not very different in appearance. The residium of a cubic foot weighed 35 grains, or the $\frac{1}{12,500}$th part. The author then enters into an approximate calculation of the medium quantity of earthly matter borne down by the Rhine during 24 hours. He assumes that the annual mean breadth of the opposite Bonn is 1,200 feet, the mean depth 15 feet, the mean velocity 2½ miles in an hour, and the average amount of solid matter held in suspension to be 28 grains in the cubic foot of water. From these data he deduces the result that 145,981 cubic feet of solid matter are borne past Bonn every 24 hours.*

CONVERSION OF SALT INTO FRESH WATER.

On August 25, was exhibited in a barge moored in the Thames, a very important experiment, made by Mr. Wells, the patentee, in the conversion of salt sea-water into a perfectly fresh and pure liquid, fit for every purpose of domestic use and economy. A number of naval officers and scientific gentlemen, were invited to inspect the process. The sea-water was brought from off Rams-

* Repertory, No. 11.

gate, and fully impregnated with the saline principle: some of it was in a very impure and dirty condition.

The apparatus invented by Mr. Wells consists of a cast-iron cooking-machine; a cube on a comparatively small scale. It seems about four feet in height, and the same in width; and contains ovens, roasting-fire, pots, pans, kettles. &c., sufficient to dress a dinner for seventy or eighty men. The consumption of fuel is very small—about two bushels, we were told, in 24 hours; and yet, by the internal application of the heated air, by means of spiral and circular tubes surrounding the various parts of the machine, roasting, boiling, and baking, are carried on with the utmost regularity and precision.

Whilst the cooking is proceeding, the sea-water is gradually supplied from a cask, or tank, as may be most ready, and, passing into the interior of the machine, is there submitted to distillation. In its distilled state it then flows into a pipe of cast-iron, or of copper tinned, which pipe is led over the bow of the vessel and along the cut-water into the sea; and thence along the bottom of the ship till it returns into the hold, with a common stop-cock to draw off the water. The grand improvement in this is, the making the element in which the vessel floats the condenser of the altered liquid; which runs off at the rate of above a quart in a minute, perfectly fit for drinking, for washing, and for every other purpose for which fresh water is employed.

The patentee, however, proceeds to filter it through charcoal, in order to restore the carbon which is lost in the distilling; and you have the pure and sparkling element, equal in every respect to spring water.*

ABSTRACT OF MR. FARADAY'S EXPERIMENTAL RESEARCHES IN ELECTRICITY.

The following complete abstract of these important results, has been drawn up for the information of the Fellows of the Royal Society.†

In the course of his experimental investigation of a general and important law of electro-chemical action, which required the accurate measurement of the gases evolved during the decomposition of water and other substances, Mr. Faraday was led to the detection of a curious effect, which had never been previously noticed, and of which the knowledge, had he before possessed it, would have prevented many of the errors and inconsistences occurring in the conclusions he at first deduced from his earlier experiments. The phenomenon observed was the gradual recombination of elements which had been previously separated from each other by voltaic action. This happened when, after water had been decomposed by voltaic electricity, the mixed gases resulting from such decomposition were left in contact with the platina wires, or plates, which had acted as poles; for under these circumstances they gradually dimi-

* Abridged from the Literary Gazette, No. 919.

† Athenæum, No. 340.

nished in volume, water was reproduced, and, at last, the whole of the gases disappeared. On inquiring into the cause of this reunion of the elements of water, the author found that it was occasioned principally by the action of the piece of platina, which had served for the positive pole; and also that the same piece of platina would produce a similar effect on a mixture of oxygen and hydrogen gases obtained by other and more ordinary kinds of chemical action. By closer examination, it was ascertained that the platina, which had been the negative pole, could produce the same effect. Finally, it was found that the only condition requisite for rendering the pieces of platina effective in this recombination of oxygen and hydrogen, is their being perfectly clean, and that ordinary mechanical processes of cleaning are quite sufficient for bringing them into that condition, without the use of the battery. Plates of platina, cleaned by means of a cork, with a little emery and water, or dilute sulphuric acid, were rendered very active; but they acquired the greatest power when first heated in a strong solution of caustic alkali, then dipped in water to wash off the alkali, next dipped in hot strong oil of vitriol, and finally left for ten or fifteen minutes in distilled water. Plates thus prepared, placed in tubes containing mixtures of oxygen and hydrogen gases, determined the gradual combination of their elements: the effect was at first slow, but became by degrees more rapid; and heat was evolved to such a degree, indeed, as frequently to give rise to ignition and explosion.

The author regards this phenomenon as of the same kind as that discovered by Davy in the glowing platina; that observed by Döbereiner in spongy platina, acting on a jet of hydrogen gas in atmospheric air; and those so well experimented on by MM. Dulong and Thénard. In discussing the theory of these remarkable effects, the author advances some new views of the conditions of elasticity at the exterior of a mass of gaseous matter confined by solid surfaces. The elasticity of gases he considers as being dependent on the mutual action of the particles, especially of those which are contiguous to each other; but this reciprocity of condition is wanting on the sides of the exterior particles which are next to the solid substance. Then, reasoning on the principle established by Dalton, that the particles of different gases are indifferent to one another, so that those of one gas may come within almost any distance of those of another gas, whatever may be the respective degrees of tension in each gas among the particles of its own kind, he concludes that the particles of a gas, or of a mixture of gases, which are next to the platina, or other solid body not of their own chemical nature, touch that surface by a contact as close as that by which the particles of a solid or liquid body touch each other. This proximity, together with the absence of any mutual relation of the gaseous particles to particles of their own kind, combined also with the direct attractive force exerted by the platina, or other solid body, on the particles of the gases, is sufficient, in the opinion of the author, to supply what is wanting, in order to render effective the affinity between the particles of oxygen and hydrogen; being, in fact, equivalent to an increase of temperature, to solution, or to any of the other circumstances which are known to be capable of adding to the force of the affinities inherent in the substances themselves.

Some very curious cases of interference with this action of platina and other metals are next described. Thus, small quantities of carbonic oxide, or olefiant gas, mixed with the oxygen and hydrogen gases, totally prevent the effect in question; while very large quantities of carbonic acid, or nitrous oxide gas, do not prevent it: and it is remarkable that

the former of these gases does not affect the metallic plates permanently; for if the plates be removed from those mixtures, and put into pure oxygen and hydrogen gases, the combination of these elements takes place.

The author concludes by some general notice of numerous cases of physical action, which show the influence of certain modifications of the conditions of elasticity at the external surface of gaseous bodies.

The seventh series, which is a continuation of the subject of the fifth, namely, electro-chemical decomposition, commences with a preliminary exposition of the reasons which have induced the author to introduce into this department of science several new terms, which appear to be required in order to avoid errors and inaccuracies in the statement both of facts and theories. As a substitute for the term *pole*, and with a view to express also a part of the voltaic apparatus to which that name has never been applied, although it be identical with a pole in its relation to the current, the author proposes to employ the term *electrode*. The surfaces of the decomposing body, at which the positive current of electricity enters and passes out, are denominated respectively the *eisode* and the *exode*. Bodies which are decomposable by the electric current are called *electrolytes*, and when *electro-chemically decomposed*, they are said to be *electrolyzed;* the substances themselves, which are evolved in such cases, being called *zetodes*, and the terms *zeteisode* and *zetexode* being applied, accordingly as the substance passes in one direction or the other. The propriety and the advantage of employing these new terms, the author observes, can be properly appreciated only by an experience of their uses and applications in the exposition of the theory of decomposition given in the fifth series of these inquiries, and of that of definite electro-chemical action advanced and supported in the present paper.

The first section of this paper is occupied with the consideration of some general conditions of electro-chemical decomposition. It has been remarked, that the elements which are strongly opposed to each other in their chemical affinities, are those most readily separated by the voltaic pile; and the discovery of the law of conduction, explained in the fourth series, has led to a great augmentation of the number of instances which are in conformity with this general observation: but it is here shown, that the proportion in which the elements of a body combine has great influence on the electro-chemical character of the resulting substance; and that numerous instances occur, where, although one particular compound of two substances is decomposable, another is not. It appears that, whenever binary compounds of simple bodies are thus related to one another, it is the proto-compounds, or those containing single proportions, which are decomposable, and that the per-compounds are not so.

The second section contains an account of a new instrument devised by the author, for exactly measuring electric currents, and which he terms the *volta-electrometer*. The current to be measured is made to pass through water acidulated by sulphuric acid, and the gases evolved by its decomposition are collected and measured, thereby giving at once an expression of the quantity of electricity which has passed. The principle on which this conclusion is founded, is the new law discovered by the author, "that the decomposing action of any current of electricity is constant for a constant quality of electricity." The accuracy of this law was put to the test in every possible way, with regard to the decomposition of water, by making the same current pass in succession through two or more portions of water under very different circum-

stances: but whatever were the variations made, whether by altering the size of the poles or electrodes, by increasing or lessening the intensity of the current, or the strength of the solution, by varying its temperature, or the mutual distance between the poles, or by introducing any other change in the circumstances of the experiment, still the effect was found to be the same; and a given quantity of electricity, whether passed in one or in many portions, invariably decomposed the same quantity of water. No doubt, therefore, remains, as to the truth of the principle on which the volta-electrometer acts: but with regard to the practical application of the principle, several forms of the instrument are described by the author, and the mode of employing them, either as the measurers of absolute quantities, or as standards of comparison, are fully pointed out.

In the third section of the paper, the primary or secondary character of the bodies evolved at the electrodes is discussed. It is shown that they are secondary in a far greater number of cases than has usually been imagined; and that laws have been deduced with regard to the ultimate places of substances, from the appearance of the secondary products; so that certain conclusions, true in themselves, have hitherto been obtained by erroneous reasoning, since the facts, which were supposed to support them, have, in truth, no direct relation with those conclusions. The methods of distinguishing primary and secondary results from each other are explained, and the importance of this distinction towards the establishment of the law of definite electro-chemical action is insisted upon by the author.

The fourth section is entitled, "On the definite Nature and Extent of Electro-chemical Decomposition," and is considered by the author as by far the most important of this, or, indeed, of the whole series of investigations of which he has now presented the results to the Royal Society. He adverts to the previous occasions on which he has already announced, more or less distinctly, this law of chemical action; and also to the instrument just explained as one of the examples of the principle about to be developed. He next refers to experiments described in another part, in which primary and secondary results are distinguished as establishing the same principle with regard to muriatic acid; the results showing, that not only the quantity of that acid decomposed is constant for a constant quantity of electricity, but that, when it is compared with water, by making one current of electricity pass through both substances, the quantities of each that are decomposed are very exactly the respective chemical equivalents of those bodies. The same current, for example, which can decompose nine parts by weight of water, can decompose thirty-seven parts by weight of muriatic acid, these numbers being respectively the chemical equivalents of those substances, as deduced from the phenomena of ordinary chemical action.

Cases of decomposition are then produced, in which bodies rendered fluid by heat, as oxides, chlorides, iodides, &c., are decomposed by the electric current, but still in conformity with the law of constancy of chemical action. Thus, the current which could decompose an equivalent of water, could also decompose equivalents of muriatic acid, of protochloride of tin, of iodide of lead, of oxide of lead, and of many other bodies, notwithstanding the greatest differences in their temperature, in the size of the poles, and in other circumstances; and even changes in the chemical nature of the poles or electrodes, and in their affinities for the evolved bodies, occasioned no change in the quantity of the body decomposed.

The author proceeds, in the last place, to consider a very important question with relation to chemical affinity, and the whole theory of electro-chemical action; namely, the absolute quantity of electricity associated with the particles or atoms of matter. This quantity he considers as precisely the same with that which is required to separate them from their combination with other particles when subjected to electrolytic action; and he brings many experiments to bear upon this point; describing one, in particular, in which the chemical action of 32·5 parts of zinc, arranged as a voltaic battery, was able to evolve a current of electricity capable of decomposing and transferring the elements of nine grains of water, being the full equivalent of that number. The relation of electricity, thus evolved, to that of the common electric machine, is pointed out in a general way, and the enormous superiority as to quantity, in the former mode of action, is insisted upon. In conclusion, the author refers to a statement which he has made in the third series of these researches, in which he expresses his belief that the magnetic action of a given quantity of electricity is also definite: and he is now more confident than ever that this view will be fully confirmed by future experiment.

MAGNETO-ELECTRICAL EXPERIMENTS MADE WITH THE LARGE MAGNET AT THE EXHIBITION ROOM, ADELAIDE-STREET.

By Mr. Sturgeon.

On Aug. 28, the following results were produced:—The decomposition of hydriodate of potassa in solution: First, by paper moistened in it placed on a platinum plate attached to the negative side of the circuit; and with a platinum point connected with the positive side, the upper part of the paper was occasionally touched, whilst the magnet was at work. At each touch, however short the interval, iodine was evolved at the positive point.

Second, a solution of the hydriodate and starch was placed in a rectangular glass box, with a gauze partition to separate it into two compartments. A platinum plate, properly connected, was placed in each compartment. In half a minute the positive cell was completely obscured by liberated iodine. A more striking experiment was never exhibited. Platinum wires, properly connected in the circuit, were placed in solution of acetate of lead:—the metal was revived on the negative wire.

Solution of sulphate of copper was also subjected to the action of the current. Decomposition immediately took place, and the negative wire became completely covered with copper.

Water was also decomposed, the hydrogen and oxygen being collected in separate tubes.

The above experiments were made by changing the connexions and reversing the current; and the results were exhibited with as much promptitude as they could have been by the employment of a voltaic battery.

Hard steel was also magnetized by being placed in a helical

part of the circuit. The poles were reversed at pleasure by changing the connexion.

A soft iron horse-shoe was magnetized to as high a degree as by a voltaic battery.

I have also made a great variety of electro-magnetic rotations, and some other rather novel motions, with electric currents by magnetic excitation, which I intend to publish as soon as opportunity permits.*

CHEMICAL AFFINITY.

During the past season, at the Royal Institution, Mr. Phillips has delivered the following instructive and useful exposition. The object of the lecturer was to define the meaning of the term chemical affinity, and to describe the causes which increase, diminish, prevent, or modify its action. He observed, that we are ignorant of the ultimate nature or cause of affinity, and know of its existence only by the effects which it produces on the various forms of matter. To admit of the action of chemical affinity, it was stated that bodies must be dissimilar; and this fact was illustrated by the action of acids and alkalies, when separate, upon vegetable blue and yellow colours respectively, and their loss of this power by combination, so as to form a salt. Another circumstance requisite to its production was mixture; to this, however, there was an apparent exception, as when an effervescent and deliquescent salt were contained in the same vessel; the latter, without being in contact with the former, would deprive it of its water of crystallization,—an effect which was stated to be due to the carrying power of the air, which conveyed the moisture from the effervescent to the deliquescent salt. Variations of temperature were mentioned as causing alterations in chemical affinity; thus,—at common temperature, mercury and atmospheric air undergo scarcely any change whatever; but, at a certain increase of heat, the mercury combines with the oxygen of the air, and is converted into peroxide; whilst, at a higher temperature than that required to form the peroxide, it is decomposed into oxygen gas and a species of mercury. Another experiment, performed to prove that affinity is dependent upon the degree of heat, was that of mixing muriate of ammonia and carbonate of lime. At common temperature, these salts undergo no change; but, when heated, it was shown that carbonate of ammonia was evolved, and what is commonly called muriate of lime remained in the vessel. It was afterwards shown, that when the carbonate of ammonia and muriate of lime formed by heat were dissolved in water, and the solution mixed at common temperature, carbonate of lime was again formed and precipitated; while the muriate of ammonia, also

* Philosophical Magazine, No. 29.

reproduced at this low temperature, remained in solution. It was observed that heat, in some cases, caused only partial instead of total decomposition: thus it was shown, that when copper was put into sulphuric acid, no action took place between them; but when heat was applied, then the copper decomposed the sulphuric acid, and, taking part of its oxygen, reduced it to the state of sulphurous acid, which was plentifully given out in the form of gas. Comminution was mentioned as sometimes requisite to cause chemical action, in other cases merely accelerating it. The first proposition was proved by the insolubility of common clay, though reduced to a fine powder in an acid; but some clay, or alumina, which had been recently precipitated, and was consequently more minutely divided, was immediately dissolved by the acid. The second case, on the acceleration of chemical action by minute division, was shown by the greater rapidity with which powdered marble was dissolved in acid than in a mass of the same substance. Concentration was likewise mentioned as another circumstance sometimes requisite to induce chemical action. Mr. Phillips afterwards observed, that oxygen was necessary to cause metals to combine with acids; and this was stated to be sometimes derived from the decomposition of a portion of the acid and water, or the atmosphere, according to the nature of the metal and the acid; further, that the introduction of a third body was sometimes necessary to ensure chemical action. This was proved by mixing very small portions of tincture of galls and sulphate of iron in distilled water;—no visible effect was produced until a drop of solution of ammonia was added, when the whole became instantly almost black. In some cases, dilution was necessary to chemical action, as when sulphuric acid requires water to cause action between it and zinc; this, however, was not owing to dilution *as such*, but because, by the decomposition of the water, the oxygen requisite to the solution of the metal was supplied to it. It was afterwards observed, that though a certain degree of oxidizement was necessary to the solution of a metal in acid, an excess might prevent it. The lecturer concluded an admirable discourse with explaining what was meant by the *nascent* state of bodies, which he said frequently was necessary to ensure chemical action.*

THERMO-ELECTRICAL BATTERY.

Dr. Locke has, within the past year, invented and constructed a very delicate thermo-electrical battery, intended to show the electricity produced by animal heat. It is of the size of three sixpences laid upon each other, that is, three-fourths of an inch in diameter, and one-tenth of an inch thick. This battery, being attached to his galvanometer, and the end of the finger applied to

* Literary Gazette, No. 918.

the top of it, the animal heat thus communicated to it, caused a current of electricity, which turned the magnetic needle 90°. Independently of this little battery, the two following experiments have been made by the galvanometer. One-fourth of a grain of metallic antimony being interposed between two copper wires, and the warmth of the finger applied, the needle was deflected 22°. One of the copper wires being laid upon the other, without the interposition of any other metal, and the warmth applied as above, the needle was deflected 6°. The same results were obtained by substituting the warmth of the breath instead of that of the hand. It may be proper to note that the temperature of the room in which these experiments were made, was 65° Fahrenheit.

It has thus been actually shown that the production and expenditure of animal heat, are, constantly, attended by electrical and magnetical currents.*

HARDENING STEEL.

At the Institution of Civil Engineers, on April 29, a conversation was held on the various methods pursued in hardening steel; and the change which takes place in the nature of the metal by immersion in water or other fluids after being raised to a red heat. It was remarked that a collection of these methods would prove very acceptable to the scientific world, and any person undertaking such a publication would be amply remunerated by the encouragement that would be undoubtedly bestowed. Where extreme hardness is required, some use a solution of sulphuric acid and water. For small articles, mercury is used, being a rapid conductor of heat, the metal is thus quickly cooled; a composition of rosin and neat's foot oil was used by the late Mr. Maudslay, for hardening circular and other saw-blades: after immersion in the composition, the blades were re-heated and dipped in oil, which became ignited and was blazed off; which is simply whirling the blade in the air until the whole of the oil is consumed. This operation gave great toughness and temper to the metal: but not such hardness as by simple immersion in water. A member remarked, that he had always found chill cast-iron to be the hardest—punches for piercing hot iron are of this nature. A member had tempered iron with good effect in liquid tallow, mixed with a small quantity of arsenic. In Germany he had known a solution of salt and water employed.—In tempering files, a member stated, that to prevent oxidation they are coated with a mixture of salt and the sediment of ale or beer. Garlic, as also soft soap, had been used for the same purpose.—It was stated that, in cutting wood for veneers, Sheffield saws, tempered in the ordinary way, were quite adequate—so much so,

* Cincinnati Paper.

that by Mr. Brunel's invention, sixteen veneers had been cut from the inch, five feet in width. Mention was made of a machine erected by Mr. Brunel, some years since, with which he could cut wood into veneers without any waste; but so strong was the prejudice against it, that the wood remained unsold after being cut; the machine was broken up, and disposed of as old iron.*

HYDROCYANIC ETHER.

M. Pelouze obtained this compound by the action of heat upon a mixture of sulphovinate of barytes and cyanuret of potassium. This ether is colourless: has a strong alliaceous smell, is extremely deleterious to the animal economy; inflammable; boils at 176° Fahr.; its density is 0·787; is very slightly soluble in water, but combines with alcohol and sulphuric ether in all proportions. It does not precipitate nitrate of silver; in which respect it resembles muriatic ether, which does not decompose this salt until it has been previously destroyed by the action of heat.

Hydrocyanic ether is formed of equal volumes of olefiant gas and cyanogen, condensed to one half: this is indicated by direct analysis and the density of its vapour.†

PATENT BRONZE SHEATHING FOR SHIPS.

There has been delivered to his Majesty's Dock-yard at Plymouth, a quantity of bronze sheathing, and directions have been given by the Lords of the Admiralty to sheathe two of the Falmouth packets that may next require coppering, one side with the patent bronze, and the other with copper, so that a comparison may be fairly established of the duration of the two substances. The bronze is a beautiful specimen of manufacture; the grain of the metal, and its composition, very much resemble that of brass ordnance. But, notwithstanding its density and polished surface, it is, at the same time, quite malleable and pliant. The subject is one of great interest, and we have, therefore, collected the following details relative to this new invention, which we understand originated with a French Engineer, and was first tried in the French Navy in 1829; since which, on account of its superior durability, ascertained by repeated experiments, the French Government has contracted for several hundred tons a year. In every instance it has been found to keep quite *clean*, a point of paramount importance; whilst, from its superior hardness, it is not so liable to be rubbed, in case of a vessel taking the ground, or running foul. The wear

* Athenæum, No. 346.

† Journal de Chimie Médicale, Sept., 1834.

of copper on ships' bottoms is a mechanico-chemical action, inasmuch as its waste at sea is six and a half times greater than in harbour. We should conclude, therefore, *à priori*, that a hard metal like bronze, would waste less by the friction of the water, than a soft metal like copper; and the great duration of ancient bronze, proves that it is less oxidable. There would thus be established a superiority in resisting mechanical as well as chemical action in favour of the bronze. The result of the experiments made in the French Navy on bronze sheathing *very imperfectly manufactured*, as stated in the "Annales Maritimes" for 1830, 31, and 32, go to prove, that when applied to ships' bottoms, the loss in weight of the bronze is less than half that of copper. It appears now established, that a continued and unceasing wasting of the metallic sheets alone secures a clean bottom, and that no galvanic protection is compatible with it; fresh surfaces of the metallic sheets must constantly be presented by the washing away of the scale or oxide: every thing that attaches to the bottom in calms or in harbour, whether seeds of marine plants, or spawn of animalculæ, is thus undermined and carried off, leaving the sheathing bright and clean. With the bronze, as with copper, the same continuous wasting is going on, but *with one-half the loss in weight*, owing to its greater hardness and density, and its inferior oxidability. Sir H. Davy's protected copper failed, because, as there was no oxide formed, the copper did not waste at all, and thus became foul. Nearly the whole of the whaling and India ships, from Havre, are sheathed with bronze, and several have returned from these long voyages with their bottoms perfectly clean, and the sheathing very little worn. It is now extensively in trial on ships from London, Liverpool, Greenock, &c., so that the results obtained in France will soon be severely tested in this country.*

CHEMICAL ANALYSIS OF THE BRAIN.

M. Couerbe, who has been engaged for some time in a chemical and physiological examination of the brain, has ascertained the singular and interesting fact, that its composition varies in a remarkable degree according to its different states of health or disease. The element, which occurs in different quantities, is *phosphorous*, of which he reports that the brain, in its normal state, contains from 2 to 2½ per cent., while the brains of idiots contain but 1 to 1½, and those of madmen 3, 4, or even 4½. "Thus," says M. Couerbe, in conclusion, "it would follow, that the absence of phosphorus from the brain would reduce man to the sad state of a brute; that a great excess of this substance would irritate the nervous system, exalt the individual, and drive him into that furious excitement which we call madness

* Plymouth Herald.

or mental alienation; and, finally, that a mean proportion re-establishes the equilibrium, gives birth to the most sublime thoughts, and produces that admirable harmony which, in fact, is *the soul* of the spiritualists." M. Couerbe's memoir has been read before the Académie des Sciences, and is published in the *Annales de Chimie.**

GAS LIGHTING.

On Feb. 28, at the Royal Institution, after a brief sketch of the origin and progress of gas-illumination in London and its environs, Mr. Brande proceeded to details connected with the present state of the manufacture, illustrating the various sources of its extension and improvement. He began by adverting to the curious and complicated products resulting from the destructive distillation of pit-coal; the principal elements of which he stated to be carbon, hydrogen, oxygen, and nitrogen, in conjunction with sulphur and iron derived chiefly from pyrites; these substances, by their mutual action during the application of a heat gradually raised to redness, yield olefiant gas, carburetted hydrogen, hydrocarbonous vapours, naphtha, naphthalin, tar, carbonic acid and oxide, cyanogen, hydrocyanic and sulphocyanic acids, sulphuretted hydrogen, ammonia, and several of its salts, water, and certain other products, of which a copious table was shown, containing also a statement of the relative proportions of gas, condensible products, and coke, afforded by three varieties of coal. Models and drawings of gas apparatus were then described, especially as illustrating the different modes of setting the retorts; and the progress of the gas from them was traced through the hydraulic main, where the tar, water, and ammoniacal liquor, are chiefly deposited, to the condensers, purifiers, and gasometers. Some observations were then made in reference to the uses and properties of the various products, in the following order:—

1. *Ammoniacal Liquor.*—This was shown to be a complicated solution of several ammoniacal and cyanic compounds in water. It is extensively used for the production of muriate of ammonia, which is obtained by saturating it with muriatic acid, evaporating, crystallizing, carefully drying the crystallized salt, and subliming it into large leaden receivers. A beautiful specimen of this salt, prepared by Mr. Leeson, of Greenwich, and weighing 2 cwt., was exhibited. Sulphate of ammonia is also prepared from the liquor; this, in its dry crystalline state, is mixed with carbonate of lime, and affords carbonate of ammonia, of which a large mass, prepared by Mr. Leeson, was also shown. The presence of sulphocyanic and hydrocyanic acid in the ammoniacal liquor was shown by saturating it with muriatic acid, and adding persulphate of iron: the detection of these compounds and their application to the manufacture of Prussian blue, Mr. Brande said was owing to the skill and ingenuity of

* Athenæum, No. 356.

Mr. Lowe. This product, therefore, of the gas manufacture, once considered as useless, yields a variety of useful and important compounds, and has opened a new field of chemical art.

2. *Tar.*—This product is useful as a coarse paint, and for the purpose of paying and caulking vessels: it is also more importantly applicable as fuel in the gas-works, where, mixed with water, it is suffered to dribble into the fire; three gallons of this mixture per hour being sufficient to heat five retorts. When distilled, it yields naphtha, a highly volatile and inflammable liquid, which is occasionally burned in lamps, or used as a solvent in the manufacture of certain varnishes.

3. *Lime Liquor.*—This is the mixture of lime and water, through which the gas has been passed, chiefly with the view of freeing it from carbonic acid and sulphuretted hydrogen: it is from time to time drawn from the purifiers and suffered to subside. The deposit, or thick portion, is made again into lime, or is used for luting the retort-lids; the clear portion is pumped into shallow vessels placed in the ash-pits of the retort-furnaces, where it evaporates, and tends to preserve the bars, probably by keeping them cool. Another use, however, is now made of it, as follows:—Acid persulphate of iron (copperas liquor) is added to it, which throws down a green precipitate, that may itself be used as a paint, but which, digested in solution of potash, yields a ferrocyanate of potash, sufficiently pure to throw down Prussian blue from common copperas liquor.

4. *Gas.*—The specific gravity of the purified gas, and, consequently, its composition, vary considerably at different periods of the distillation; its average specific gravity, as taken from the gasometers, is 0·410; each cubic foot weighing 240 grains. After some remarks upon the manufacture of gas generally, and upon the various forms of carbon, and other products occasionally found in the retorts, Mr. Brande made some observations upon the sources of the luminosity of different gases, and on photometers; and then proceeded to details connected with the process as carried on upon the large scale by the different companies; stating that his experience was chiefly derived from the Chartered Gas Company, the officers of which had most assiduously assisted him in all inquiries connected with the subject generally, and with the particular object of the present inquiry; Mr. Lowe, and Mr. Frederic Winsor, had kindly given him access to their information; and Mr. Crossley had supplied models of gas-meters and their appendages, with much of the other apparatus upon the table. Mr. Brande estimated the number of retorts worked by the above-mentioned company at 750; and assuming them to be about one-fourth of the number employed in London, the whole amount will be 3,000 retorts, of about 15 cwt. each; so that the cast-iron thus employed, to say nothing of the enormous amount in pipes and other apparatus, amounts to 2,240 tons. The total stowage for gas in the gasometers of the chartered company, Mr. Brande estimated at 820,000 cubic feet; or, for London, 3,280,000 cubic feet. He said, that the number of burners supplied by this company amounted to about 42,000; or, for the whole of London, to 168,000; and, estimating the consumption of each burner at five cubic feet per hour, the average *hourly* consumption of gas would amount to 840,000 cubic feet; and taking five hours per day as the average time of burning, we have 4,200,000 cubic feet of gas as the daily average consumption. Mr. Brande concluded by explaining the different checks resorted to by the companies in reference to the quantity of gas produced and consumed; and by a de-

scription of the gas-meters, pressure-gauges, tell-tales, and governors, all illustrated by a series of excellent models and apparatus. The following tables were exhibited, as furnishing data and details connected with several of the points referred to in this lecture, together with some others which we have not room for, showing the relative weights and volumes of gas, and of the consumption of atmospheric air in its combustion:—

For the total annual supply of gas to the metropolis, there are required 200,000 chaldrons of coal, yielding 2400,000,000 cubic feet of gas; the gas weighing 75,000,000lbs. The light thus produced is equal to 160,000,000lbs. of mould candles, of 6 to the lb.; the bulk of the coal is equal to 10,800,000 cubic feet, or 400,000 cubic yards; or to a cube of 222 feet in the side, or of 74 yards.*

REFINING GOLD.

On Feb. 3, at the Paris Academy of Sciences, M. Boussingault read a memoir relative to the action of acid hydro-chloric gas on silver, at a high temperature, with observations on the *depart sec.*

Formerly, chemists gave the name of *depart sec* to an operation, by means of which they succeeded in separating from gold, the silver and other metals amalgamated with it. The dry work, as it is called, of separating those metals, may be traced to the highest antiquity; and it was only about the year 1350, that their separation by aquafortis began to be known in Europe. During a long period it was confined to the laboratory of the assayers.

Chemistry having since made immense progress, the low price of acids, which was a consequence of it, soon allowed them to effect the separation no longer by the *voie seche*, but by the *voie humide.* Yet, so little are the arts advanced in Europe, says M. Boussingault, that in many *ateliers* I have very lately observed the old mode of proceeding used in the middle ages. Thus, in such an important establishment as that of New Granada, the separation of silver from the gold of the mines, is still performed by cementing albiazo in a mixture of brick-dust and sea salt, causing to pass over red hot silver a current of hydro-chloric gas, the acid is decomposed, the chlorure of silver is formed, and disengages itself from the hydrogen gas.

The decomposition of hydro-chloric gas by silver, is a fact analogous to that of the decomposition of water by iron. Silver fixes the chlorine of the acid, as iron unites itself to the oxygen of the vapour of water: in the two cases, the hydrogen is free. Nevertheless, at the same temperature at which those metals become decomposed, hydrogen retains the property of reducing, to the metallic state, the chlorure of silver and the oxide of iron, producing hydro-chloric acid and water.†

* Literary Gazette, No. 895. † Athenæum, No. 330.

NATURAL HISTORY.

ZOOLOGY.

AFFECTION AND VAST NUMBER OF FISHES.

It may be supposed that little natural affection exists in this cold-blooded race, and, in fact, fishes constantly devour their own eggs, and, at a later period, their own young, without compunction or discrimination. Some few species bear their eggs about with them until hatched; thus, the *syngnathi* (sea-horse, Pegasus, &c.) have, beneath the base of the tail, a small cavity, closed by two scaly pieces, which lap over it like folding doors. Within these are placed the eggs, enveloped in a fine membrane, and are allowed to remain there until the young ones appear. This we thought about the utmost extent of care which fishes lavished on their young; but Dr. Hancock has stepped in to rescue at least one species from the unmerited charge.

"It is asserted," he says, "by naturalists, that no fishes are known to take any care of their offspring. Both the species of *hassar* mentioned below, however, make a regular nest, in which they lay their eggs in a flattened cluster, and cover them over most carefully. Their care does not end here; they remain by the side of the nest till the spawn is hatched, with as much solicitude as a hen guards her eggs, both the male and female hassar, for they are monogamous, steadily watching the spawn, and courageously attacking the assailant. Hence the negroes frequently take them by putting their hands into the water close to the nest, on agitating which, the male hassar springs furiously at them, and is thus captured. The *roundhead* forms its nest of grass, the *flathead* of leaves. Both at certain seasons burrow in the bank. They lay their eggs only in wet weather. I have been surprised to observe the sudden appearance of numerous nests in a morning after rain occurs, the spot being indicated by a bunch of froth which appears on the surface of the water over the nest. Below this are the eggs, placed on a bunch of fallen leaves or grass, which they cut and collect together. By what means this is effected seems rather mysterious, as the species are destitute of cutting teeth. It may possibly be by the use of their arms, which form the first ray of the pectoral fins."*

* Zoological Journal, No. 14.

Pennant, indeed, gives an additional instance of parental affection in this much wronged class, for he says, that the blue shark will permit its young brood, when in danger, to swim down its mouth, and take shelter in its belly! The fact, he tells us, has been confirmed by the observation of several ichthyologists, and, for his part, he can see nothing more incredible in it than that the young of the opossum should seek an asylum in the ventral pouch of its parent. He does not tell us, however, that any of these ichthyologists, who may have seen the young sharks swimming down the throat of their affectionate parent, ever saw one of them *returning;* and until that is seen, we must think the evidence rather incomplete, more particularly as the position and direction of a shark's teeth seem to us to render such a feat next to impossible.

But affection is scarcely to be looked for where the offspring is so very numerous as to put all attempts at even recognising them out of the question. How could the fondest mother love 100,000 little ones at once? Yet this number is far exceeded by some of the matrons of the deep. Petit found 300,000 eggs in a single carp; Leuwenhoeck, 9,000,000 in a single cod; Mr. Harmer found, in a sole, 100,000; in a tench, 300,000; in a mackerel, 500,000; and in a flounder, 1,357,000.* M. Rousseau disburthened a pike of 160,000, and a sturgeon of 1,567,000; while from one of this latter class, some other person (whose name we do not immediately recollect), got 119 pounds weight of eggs, which, at the rate of seven to a grain, would give a total amount of 7,653,200 eggs! If all these came to maturity, the world would be, in a short time, nothing but fish; means, however, amply sufficient to keep down this unwelcome superabundance, have been provided. Fish themselves, men, birds, other marine animals, to say nothing of the dispersions produced by storms and currents, the destruction consequent on their being thrown on the beach and left there to dry up, all combine to diminish this excessive supply over demand. Yet, on the other hand (so wonderfully are all the contrivances of nature harmonized and balanced), one of these apparent modes of destruction becomes an actual means of extending the species. The eggs of the pike, the barbel, and many other fish, says M. Virey, are rendered indigestible by an acrid oil which they contain, and in consequence of which they are passed in the same

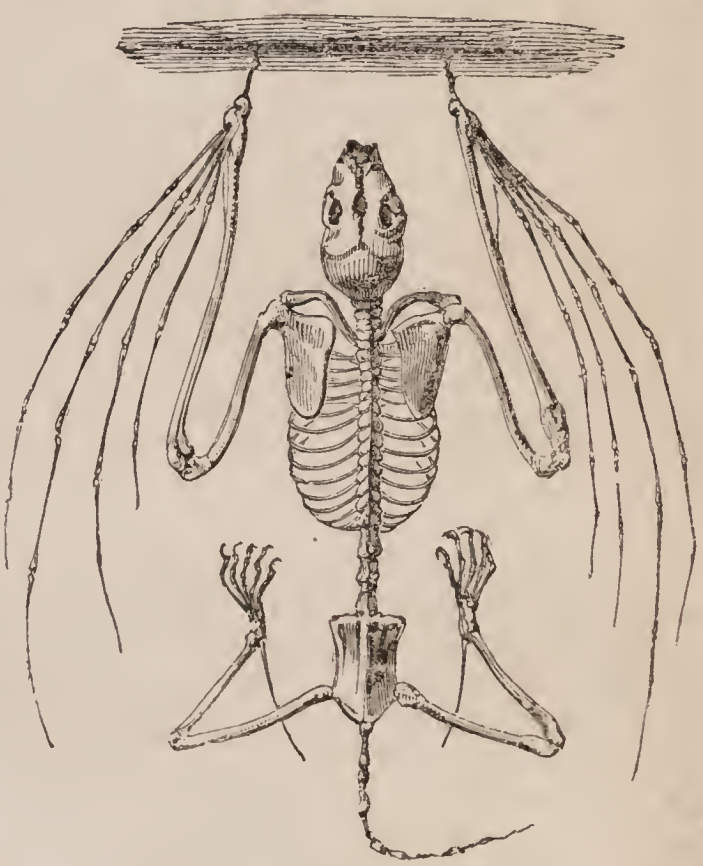
* Mr. Harmer's paper will be found in the Philosophical Transactions for 1767. The results of his investigations he has reduced to a tabular form at the end. A tench was brought to him so full of spawn, that the skin was burst by a slight knock, and many thousands of the eggs lost; yet, even after this misfortune, he found the remainder to amount to 383,252! Of other marine animals which he includes under the general term fish, the fecundity, though sufficiently great, is by no means so enormous. A lobster yielded 7,227 eggs, a prawn 3,806, and a shrimp 3,057.

condition as they were swallowed, the result of which is, that being taken in by ducks, grebes, or other water fowl, they are thus transported to situations, such as inland lakes, which, otherwise, they could never have attained; and in this way only can we account for the fact, now well ascertained, that several lakes in the Alps, formed by the thawing of the glaciers, are now abundantly stocked with excellent fish.*

THE SKELETON OF THE BAT.

Sir Charles Bell, in his valuable treatise on *The Hand*, considers the skeleton of the bat as one of the best examples of the moulding of the bones of the extremity to correspond with the condition of the animal.

Contemplating this extraordinary application of the bones of the extremity, and comparing them with those in the wing of a bird, we might say that this is an awkward attempt — "a failure." But before giving expression to such an opinion, we must understand the objects required in this construction. It is not a wing intended merely for flight, but one which, while it raises the animal, is capable of receiving a new sensation, or sensations in that exquisite degree, so as almost to constitute a new sense. On the fine web of the bat's wing, nerves are distributed, which enable it to avoid objects in its flight, during the obscurity of night, when both eyes and ears fail. Could the wing of a bird, covered with feathers, do this? Here, then, we have another example of the necessity of taking every circumstance into consideration before we presume to criticize the ways of nature. It is a lesson of humility.



(The Skeleton of the Bat.)

In this animal the bones are light and delicate; and whilst

* Foreign Quarterly Review.

they are all marvellously extended, the phalanges of the fingers are elongated so as hardly to be recognised, obviously for the purpose of sustaining a membraneous web, and to form a wing.

DEATH FROM THE BITES OF SPIDERS.

A LETTER from M. Graëlls, of Barcelona, has been read at a meeting of the French Entomological Society, of which the following is an extract:—"The appearance of a spider, the bites of which gave rise to serious accidents amongst the people of *El campe de Tarragonas*, and even caused death to some of a feeble constitution, was first noticed in 1830. It attracted the attention of the Medical and Surgical Academy of Barcelona, which named a commission, to examine persons bit by this spider, and ascertain its species. Unfortunately, this last point was difficult to verify, as the country people had commenced destroying every spider they met, and could not point out that which they considered noxious. In 1833, this scourge appeared for the second time amongst the inhabitants of *El Vendrell*, in the same district, producing the same accidents, and in such numbers, that the peasants dared not go out to their work. A second commission was named, of which I was one, and I ascertained that the injurious spider was the *Theridion malmignatte*, the Aran. 13-guttata of Fabricius."—In consequence of this letter, some observations were made: M. Lefebvre related, that, despite all his pains, he had been unable, during his sojourn in Sicily, to find either this *Theridion* or the *Tarentula*. Yet people were constantly telling him of a venomous spider, without, however, presenting him the animal, or describing it in any precise manner. Among the strange, exaggerated, and contradictory reports, which were given him of the injuries it produced, as well as the proper modes of cure, he never heard of death being the result of the bite of this spider, but merely prolonged lethargies, fevers often sufficiently violent, together with shocks to the nervous system, which were generally recovered from. Thus, he was told, that in harvest time, a woman of Colessano, having gone to sleep in the corn, was bit by one of these spiders in the neck, and that having become lethargic in consequence, she remained two or three days in a state of torpor, from which she was only recovered by constantly rocking her in a cradle to the sound of music. His informant was a muleteer, who said he had assisted at the dances, which they believed necessary to arouse this woman. The Sicilians designating all spiders, particularly those of the fields, by the common name *Tarentola*, brought the first they found to M. Lefebvre as specimens of the venomous species. He remarked, that those presented him were generally of the smaller kinds, not *Epeiræ*, but *Thomisi*, *Lycosæ*, and *Eresi*, whence, he concluded, that there might probably be a

Theridion, the size of which, it is well known, does not exceed that of most species of the above genera. He was assured that oil and *theriacum* were generally employed with success against the bites of this spider, which was particularly dreaded in the Val di Noto, at Randazzo, a little town at the north side of Mount Ætna, and at Colessano, where they termed it *Tarentola Ballarina.**

STRUCTURE OF THE BRAIN.

THE "Annalen der Physik und Chemie" von Poggendorff, No. 7, 1833, contains an essay by Professor Ehrenberg, of Berlin, entitled, "The necessity of a minute mechanical examination of the brain and nerves, in preference to the chemical analysis illustrated by observations," in which there is given an account of some observations recently made by him with regard to the minute structure of nervous tissue, as seen by the aid of a very powerful microscope.

Many attempts of a similar nature to examine the structure of that fibrous-like texture which is in general seen in some parts of a fresh brain, and which becomes more obvious when the brain has been artificially hardened by steeping in alcohol or a solution of the muriate of mercury, or by boiling in oil, have been made ever since the microscope came into use, but these attempts have led, as yet, to very unsatisfactory results.

A hasty repetition of Professor Ehrenberg's observations has not shown us the appearances described by him; but the well merited character for accuracy and skilfulness in the use of the microscope, which that observer has acquired by his interesting researches on the structure and functions of Infusoria, makes us hope that they may be found to be correct, and satisfies us that a short account of them will, at all events, be interesting to anatomists and physiologists.

The discordance in the accounts given of the structure of the brain and nerves by Leewenhock, Della Torre, Monro, Barba, Home, and others, and the unsuccess which has generally attended this investigation, may in some degree have proceeded from unskilful management of the microscope on the part of some, — from different modes of examination having been adopted by others,—from a total ignorance with regard to the disposition of the elementary texture in which the nervous matter of the brain has been generally believed to be contained,—from the supposition that has prevailed, that a fluid, or mucuous matter, might constitute the matrix in which the nervous filaments are deposited,—and from the circumstance that fibres of very different magnitude have been looked for in the nervous texture by different observers.

* Athenæum, No. 360.

Professor Ehrenberg has shown, that the proper nervous substance of the Brain and Nerves does actually consist of very minute fibres; and he informs us that these fibres can only be discovered by the aid of a magnifying power of 300 diameters, and that he was sometimes obliged to have recourse to a much greater magnifying power, as 800 diameters, in order to bring them into view. He examined thin slices of the recent brain, and states that the fibrous structure was in general most obvious at the thin margins of the slices, when these were simply laid on the object glass-holder of the microscope, and that gentle pressure of the nervous substance between two thin plates of glass generally rendered the fibres more apparent.

The great mass of the Cerebrum and Cerebellum consists, according to Professor Ehrenberg, of very minute fibres irregularly disposed in the cortical part, and there interspersed with globules and plates, converging as they pass inwards from the surface towards the centre of the brain. The greater number of these fibres have not a regular cylindrical shape, but present the appearance of strings of pearls, the swelled portions being situated at some distance from one another, and united by narrower parts which are continuous with them, and are formed apparently of the same material. Besides these fibres, which Professor Ehrenberg calls *articulated*, from their knotted appearance, this observer states, that towards the base of the brain and crura cerebri, other somewhat larger fibres, of a regular cylindrical form, are to be observed, interspersed among the articulated or knotted ones. These two sets of fibres are not held together by cellular tissue, nor fluid, nor mucous matter, but appear to be nearly in juxtaposition with one another, except where they are penetrated by the net-work of minute blood vessels, which are every where distributed through the brain. The cortical substance seems, according to Ehrenberg's observations, to differ from the medullary, or white substance, chiefly in the want of the straight cylindrical fibres, and in the articulated fibres being contained in a denser net-work of blood vessels, and being covered by a layer of free ganules larger than the dilated parts of the knotted fibres.

In the brain, the fibres run, for the most part, parallel to one another; they are sometimes seen to cross, and, in a few instances, Professor Ehrenberg states, that he has observed two fibres uniting into one, but never any distinct anastomosis.

The larger straight Cylindrical fibres, he states, are manifestly tubular, because it is possible to see the inner paries of the tube, and on dividing some of these fibres, and gently pressing them between plates of glass, a granular medullary matter was made to issue from them. In the Knotted or Articulated fibres, he never was able to discover a distinctly tubular appearance, nor could any matter be pressed from their interior; but notwithstanding this, Ehrenberg considers these also as tubular.

Professor Ehrenberg has observed a remarkable difference in the minute structure of some of the Nerves of special sensation, the great sympathetic nerve, and the compound spinal nerves. He finds that the olfactory, the optic, and the auditory nerves, as well as the branches of the great sympathetic, are entirely composed of knotted or articulated fibres, similar in size and appearance to those forming the great bulk of the nervous matter in the cerebrum; while the nerves of motion, and the regular spinal nerves, are entirely composed of the straight cylindrical tubular fibres.

The cylindrical tubular fibres of the spinal nerves, and of the nerves of motion coming from the brain, are considered by Professor Ehrenberg as prolongations of some of the articulated fibres of the brain itself, for he has observed, at the origin of a nerve of motion, that the articulated fibres gradually lose their knotted appearance as they pass into the root of the nerve, and increasing slightly in diameter, become the straight tubular cylindrical fibres proper to nerves of this description.

The net-work of the retina affords an excellent opportunity of viewing the articulated cerebral fibres; but in order that these may be well seen, there must be removed from their surface a layer of coarse granules, nearly of the diameter of the nuclei of the blood globules, and similar to those which cover the flattened extremities of the articulated fibres, at the surface of the cortical substance of the brain.

It remains still to be investigated, whether the knotted kind of fibres are only to be found in the nerves above mentioned, or are peculiar to all sensory nerves, while the cylindrical tubular fibres are peculiar to motory nerves.

Both the cylindrical and the articulated fibres, as they pass from the brain into the roots of the nerves, receive a nervous covering, or neurilema, which invests each individual fibre, and each bundle of fibres, as well as the whole trunk of the nerve, with a dense cellular and vascular coat.

The cylindrical fibres are stated to be about $\frac{1}{120}$ of a line in diameter.

It must not be supposed that Professor Ehrenberg has confounded the tubular appearance of the nervous fibre with that of the neurilema, for he professes to have accurately distinguished the limits of both these parts.

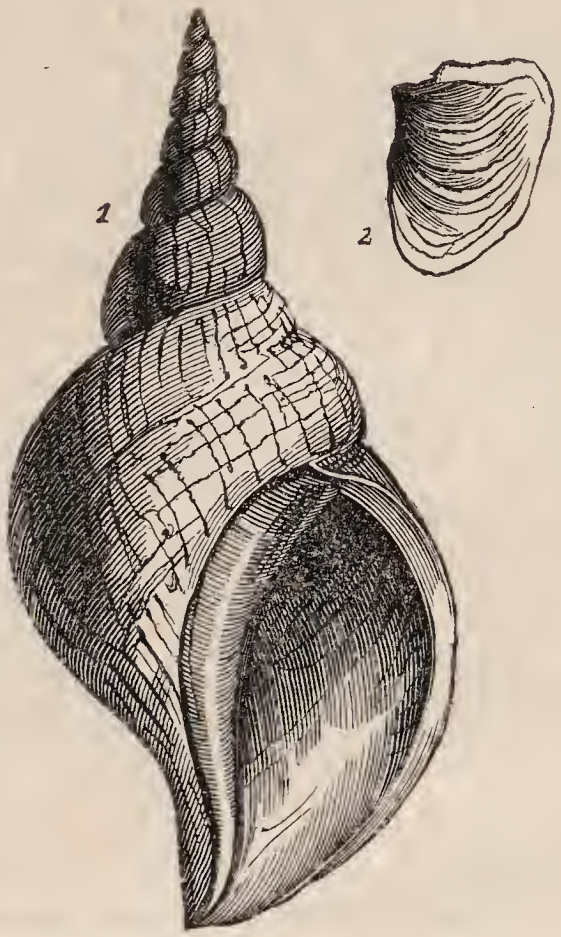
The Ganglia are described by Professor Ehrenberg as somewhat resembling the brain, in respect to the nature of the fibres composing their nervous substance. They are formed by reticulated collections of both articulated and cylindrical fibres, interspersed with granules and cellular texture. In some places in the ganglia, he has also remarked a greater than ordinary enlargement of the swellings of the articulated fibres.

These observations have been made on the human brain, and on that of some quadrupeds, of birds and reptiles, with nearly the same results in all.*

RARE SHELL.

The following Fùsus Turtòni Bean, a rare and hitherto undescribed species of shell, is described and illustrated, by William Bean, Esq., in the *Magazine of Natural History*, No. 43.

Fùsus Turtòni Bean.—Shell fusiform, covered with slightly elevated spiral lines broader than the intervening spaces, and crossed by numerous longitudinal lines of growth. Length 4½ in., and about 2 in. broad; volutions 9, a little raised in the middle, from which they gradually slope to the separating line; aperture ovate, nearly of the same length as the spire; canal wide and short; outer lip a little dilated and very thick; inner lip smooth, glossy, and much spread on the pillar. Colour white, covered with a brown epidermis, and the inside pale violet.



(1. Fusus Turtoni. 2. Its operculum.)

This noble and probably unique shell we have named after our old and esteemed friend, Dr. Turton. It was found among the rejectamenta of a boat at Scarborough, and is one of the "great guns" of our collection, which contains (we say it proudly) 1,050 species and varieties, and above 50,000 specimens of genuine native shells.

NERVOUS SYSTEM OF THE COD-FISH.

On Feb. 15, Dr. T. J. Aitken submitted to the consideration of

* Jameson's Journal, No. 33.

the Wernerian Society, a view of the brain and cerebral nerves of the cod in general, and of the olfactory nerve in particular, being part of the results of his late physiological and anatomical investigations into the nervous system of this animal. He showed that the olfactory cavities are comparatively small, though beautifully and elaborately constructed; these cavities communicate externally by means of two orifices, each furnished with a valve-like apparatus. The surface is covered by a mucous membrane, elegantly plaited, and defended by an abundant quantity of thick viscid mucus. Pursuing the usual mode of tracing nerves from the brain, he pointed out the olfactory connected with the inferior surface of the anterior tubercles, from which they arise by two or three capillary roots; the two nerves soon unite and run together as one nerve, along a canal leading from the skull forwards; they next enter a large oblong cavity, filled with a similar fluid to that which occupies so considerable a part of the skull. Here the nerve again divides into two, which diverge to their respective olfactory organs, on the central, internal, or convex surface of which they are swollen into a ganglion, affording one of the few examples of this modification of nervous structure in the organization of fishes. From the ganglion numerous threads are seen passing to the membranes which penetrate it, and are dispersed freely upon it to receive the impressions of odorous emanations. He observed, that though cod, when urged by the cravings of hunger, swallowed their food, apparently regardless of its odour, and indeed occasionally voraciously devouring almost every thing which comes in their way; yet, on the other hand, when surrounded by an abundance of their favourite subsistence, as the herring, become extremely nice, and may be seen to submit the bait to the sense of smell, and according to the satisfaction afforded by the test, either take it or turn away with indifference or apparent contempt. After pointing out several peculiarities in regard to the other nerves, Dr. A. stated it as his intention to submit to the Society further views in the same department on a future occasion.*

EFFECT OF COLD UPON INSECTS.

Mr. Browne relates, in the *Magazine of Natural History*, some interesting facts in proof of the little effect produced by extreme cold in destroying life in insect eggs. The vulgar notion is (and *à priori* it seems a probable one), that a severe winter is destructive of insects; and, consequently, that there will be fewer than usual during the succeeding summer. Experience, however, shows that this is not the case; and that the scarcity or abundance of insects has little or nothing to do with the severity or mildness of the preceding winter. The fact is,

* Jameson's Journal, No. 35.

insects, either in the egg, larva, pupa, or perfect state, are, in the ordinary course of things, *liable* to be exposed to severe cold; and, therefore, nature has provided for them accordingly, endowing them with constitutions calculated to endure the degree of cold which they will have to encounter. It may be added, that these little creatures seem to be proof also against some other vicissitudes of nature less regular in their occurrence than the periodical returns of winter's cold. The following fact, communicated by the late Mr. Haworth, may serve as an illustration:—Some entomologists once made an excursion into the fen countries, for the purpose of taking the beautiful lycæna díspar, or large copper butterfly; which, it is well known, frequents low marshy grounds. The coppers were captured in good abundance. It so happened that the following winter proved to be a wet one; and the entire tract of land where the coppers had been found was completely inundated, and actually lay under water for a considerable time. The entomologists deemed that the flood would certainly destroy the coppers, and that the race would become extinct in that part of the country. The next summer, however, the butterflies were found again, in the very same spot, as plentifully as before. Subsequently, the tract of land was submitted to the action of fire, and the whole surface burnt with a view to agricultural improvement. It need hardly be added, that, after this operation, the coppers were no longer to be met with in that particular locality.*

ON SOME OF THE CETACEA.

By Professor Traill.

It has, I believe, excited considerable surprise in this country, to observe the keen discussions which have lately taken place between Geoffroy St. Hilaire and other French naturalists on the nutrition of the Cetacea.

British naturalists have long considered the existence of mammæ, the secretion of milk, and the lactation of their young, as among the best established facts in the natural history of that order of animals; but it would appear that, on the recent capture of a considerable number of a large species of Delphinus, Geoffroy St. Hilaire has endeavoured to throw doubts on the received opinion on this subject, on grounds chiefly derived from an observation some time ago made by *Baër*, that the mammæ of the Cetacea were analogous to the abdominal glands of the Ornithorhynchus and Echidna, two animals which, from the common termination of the fœcal, urinary, and generative organs, Geoffroy had proposed the generic name of *Monotrèmes*. This assertion of Baër seems to have been the origin of the scepticism of that distinguished naturalist.

* Magazine of Natural History, No. 42.

The questions which have been discussed in France are involved in four propositions :—

1. Have the Cetacea *mammæ?*—2. If they have, do they secrete milk?—3. Have they a nipple? And, 4. Do the young derive their nourishment from the teats?—The three first have been long ascertained by various naturalists.

The ancients appear to have had very correct notions respecting these points, particularly in one genus of cetaceous animals, the *Delphinus*. Aristotle had remarked the striking affinity of the Cetacea to the Mammalia inhabiting the land; and states, "that young dolphins are nourished by the milk of their mothers as they swim in company with them." Pliny is more express when speaking of the same genus: "*Nutriunt uberibus, sicut Balænæ.*" "*Quin et adultos diu comitantur; magnum erga partum charitate.*"

The fact of whales possessing teats is so well known to our Greenland sailors, that I never heard it doubted by any of them whom I have examined on the subject; and I have repeatedly heard them describe the milk which flows from the udder of the female whale when it is pressed. Mr. Scoresby, one of our most accurate observers, thus describes the lactiferous system of the great whale, *Balæna mysticetus:* "Two paps in the female afford the means of rearing its young. They are situated on the abdomen, on each side of the pudendum, and are two feet apart. They appear not to be capable of protrusion beyond a few inches. In the dead animal they are always found protruded.

"The *milk* of the whale resembles that of quadrupeds in its appearance. It is said to be rich and well flavoured." (Arctic Regions, i.)

I have had opportunites of examining several species of Delphinus, and can positively assert that the females have mammæ, which are furnished with *teats*, or *nipples*, and which secrete milk.

It is known to some of my friends, that, in 1809, I described, chiefly from the drawings and notes of the late Mr. James Watson, of Orkney, a new species of *dolphin*, to which I gave the name of *Melas*, from its glossy blackness; but for which I afterwards proposed the trivial name of *Deductor*, from its gregarious disposition and propensity to follow a leader. The first description was published in the 22nd volume of *Nicholson's Journal;* the second in *Scoresby's Arctic Regions*. In both, the fact of the young being nourished by sucking the dams is noticed, but shortly, because it was considered as too well established to admit of any doubt; but I am enabled, from Mr. Watson's notes, now in my possession, to state more fully this fact, as witnessed by him in the herd of 92 individuals of that species stranded at once in the Orkney islands; from which, the drawings and descriptions published by me were originally derived.

In a letter, dated in 1807, Mr. Watson thus writes: "On the

13th of December last, 92 whales, of the Delphine genus, were killed in the bay of Scapay." "They were of various sizes, from five to twenty feet in length; the smallest were destitute of teeth, and *sucking their dams*."

Another individual, who was then also present, and is now with me while I write, gives the following account of that extraordinary scene:—"When the whales were driven on shore in Scapay Bay, the young ones continued to swarm round their dams, until the receding tide left them also dry. During this interval, I observed some of them clinging to the teats of their mothers. When separated, the milk flowed from the teats in great quantity. It was white; and, as it flowed, of the consistence of thin cow's milk; but, on standing, it seemed to throw up cream, or to become more rich in appearance. As I walked round the animals, pools of milk were here and there distinctly visible. The moans of the mothers were most piteous, especially when their young were removed. This induced one of my servants to lift a small whale, and apply it to the mother's teat, of which it immediately laid hold. I cannot recollect that I saw it absolutely *sucking;* but it grasped the teat with its toothless mouth, and my impression was that it sucked."

These facts were witnessed by hundreds of persons, among whom I never met with one who thought differently on the lactation of the *Delphinus Deductor*.

Among Mr. Watson's papers I have found several measurements of this species, besides those already published by me.

"The eye, 2 inches long, and $\frac{5}{8}$ths broad, is placed about 18 inches from the point of the snout.

"On the back of the head, and in a line with the eyes, was placed the spout-hole, of a semilunar shape, 4½ inches in length, by 2 broad.

"Length of the animal" (from which the drawing was made), "20 feet, and girth, 11½ feet. Pectoral fins, 5½ feet by 15 inches. Tail, 5½ feet wide, by 2 feet deep.

"Teeth conical, about 1½ inches long, bent a little inwards; and in those *under* the largest size, there were 24 in each jaw; those *full grown* seemed to have lost some of their teeth."

It seems to be probable, that the animal lately described as a new species by the French *savans*, under the name of *Delphinus Globiceps*, is only my *D. Deductor*, which has a semiglobular snout.

I may here remark, that, in my original description, by a misprint, the pectoral fins were said to be *from* 6 *to* 8, instead of *from* 4 *to* 6 feet long. Another, of which the measurements were published in Scoresby's work, had a length of 19½ feet, and the free part of its pectoral fins was only 3½ feet by 1½ foot.

In this species the spiracle has its cornua pointing forward. Mr. Scoresby has also published a figure and admeasurements of *Balæna Rostrata*, taken by Mr. Watson from a stranded speci-

men. In Mr. Scoresby's work, the circumference is stated at 20 feet; but in another set of admeasurements, in Mr. Watson's handwriting, I find the girth given at 10 feet only.

This species of whale may be readily discriminated from the young of the allied species, by the colour of its palatal laminæ, which are in it *whitish*, while they are dark brown in the other species.

A fine specimen of the *B. rostrata* was, about two months ago, caught in the Frith of Forth, and exhibited in this city. It agreed exactly with the Orkney specimen in its external appearance; and the following account of its anatomical structure has been published by *Dr. Knox*, who has dissected the animal:*—

In February, 1834, a young whalebone whale was taken near the Queensferry, in the Frith of Forth. After being exhibited for a short time by the proprietors, it was dissected by the author as carefully as time and circumstances would permit. The term rorqual is employed throughout this memoir in the sense employed by M. Cuvier, as designating "whalebone whales, with longitudinal folds under the throat and chest." He thinks the present specimen quite distinct, specifically from the "great rorqual," (the Balæna boops, jubarte, musculus, &c.), and not as M. Cuvier seems to think it, a mere variety. Among other distinctions, the great rorqual has 13 dorsal, and 43 lumbar, sacral, and caudal vertebræ; while the individual now under consideration has only 11 of the former, and 36 of the latter. There are, therefore, at least two species of rorquals inhabiting the North Seas, viz. the great rorqual, and the one now under consideration, a specimen of which was described by Fabricius (balæna rostrata); another dissected by Hunter, and a third casually observed by James Watson, Esq., who sent a drawing of the same to Dr. Traill, by whom it was communicated to Mr. Scoresby.

The author had not leisure to examine the osteology with sufficient care; the following results have, in the meantime, been attained.

Internal and External Character.—Eight distinct bristles, arranged in perpendicular rows, were found in the extremity of the snout, in both jaws. The lower part of the mouth is a huge pouch, which, in the great rorqual, must at times contain a vast volume of water. The tongue was free towards the apex; and the inside of the mouth of a pale rose or vermilion colour.

The whalebone was about 2½ inches in length, varied from a pale rose colour to a dull white, and 614 large external plates were counted. No vestiges of teeth were found in either jaw; but it is not improbable that they exist in the fœtus of this species, as well as in that of the mysticetus, in the lower jaw of which, lying imbedded below the gum, a series of teeth was discovered by M. Geoffroy St. Hilaire, several years ago; and in which the author of this paper has since observed them in the *upper jaw*.

* Jameson's Journal, No. 33.

Brain and Nervous System.—The cranium, besides containing the brain and its membranes, incloses a very large mass of a vascular substance, closely resembling an "erectile tissue." This forms an exception to the hitherto uniformly observed law of coincidence, at least in the mammalia, between the configuration of the inner table of the skull and the contained brain. The erectile tissue filled a large proportion of the interior of the cranium, also three-fourths of the spinal canal, where it surrounded the spinal marrow and nerves; being in some places nearly two inches in thickness. The whole cerebral mass, comprising two inches of the spinal chord, weighed 3½lbs.; while the cerebellum, pons, and two inches of the chord, weighed only three-fourths of a pound.

Respiratory Organs.—The mode of breathing, and the structure of the nostrils, was precisely as in the great rorqual. Two bolster-like substances filled the nostrils, which are withdrawn from them at the moment of breathing by muscles provided for that purpose. There are turbinated bones in the nose and olfactory nerves, as large at least as the human. The author thinks it impossible for water to be habitually spouted through the nostrils. The whalebone whales have complex nostrils, and smell and breathe precisely as the higher orders of the mammalia.

The *Stomach*, composed of four compartments, contained no food. The middle tunic of the *ureter* was composed of distinct longitudinal muscular fasciculi.

The author then proceeded to consider, at some length, a question which had lately arisen relative to the structure and functions of the abdominal glands of the cetaceæ, and which has been six or seven times before the French Institute in the course of the late and present session,—viz. Whether these glands are mammiferous? M. St. Hilaire conceives that they are not mammæ, and do not secrete milk, but that they are probably similar to those of the *ornithorhynchus paradoxus*, which he thinks are sexual, specific, and odoriferous, but not mammiferous.

The author first observed, that the question ought, in strictness, to be limited to the whalebone whales among the cetaceæ; because the great group of the *delphinus* was proved to be mammiferous long ago by Mr. Watson, an extract of whose observations is given in "Scoreby's Greenland." He next stated, that his own observations left, in his opinion, no doubt whatsoever, that the similarly situated glands in the *balæna rostrata* are also true mammæ. An elaborate anatomical examination showed that they resembled the lactiferous glands of other mammalia in their structure. A cursory examination of the fœtal *mysticetus*, led to the same conclusion in regard to that genus; and the author was farther informed by a former pupil, Mr. Auld, that in the young mysticetus harpooned, he had seen a fluid of a cream colour and consistence, and oleaginous taste and smell, issue abundantly from the mouth; and, in the full-grown females, he had forced out several pounds of a similar fluid from the orifices of the glands by pressure of the foot on the abdomen.

The specimen of balæna rostrata examined by the author was 9 feet 11 inches in length, 3 feet from snout to ear, and 4 feet 8 inches in girth at the termination of the plicæ and folds.*

HOUSE FLIES.

On April 7, the Secretary of the Entomological Society read a paper by Mr. Spence, detailing a curious mode, adopted in Italy, of excluding the house-fly from houses. The plan consisted simply in straining a net, made of white thread, across the aperture of an open window: the meshes of the net were about half an inch in diameter. It had occurred to Mr. Spence, whether it could be the dread of a spider's net which caused the flies to avoid the thread net, but on consideration he had determined otherwise, and he was totally at a loss how to account for so singular a circumstance. Mr. Spence expressed a wish that the metaphysical history of insects might be more attended to than had at present been the case; he thought much instruction would result from it.†

A YOUNG RHINOCEROS.

This fine specimen of the Indian one-horned rhinoceros was brought to England last spring, for the Surrey Zoological Gardens. The great value attached to the possession of a living specimen of this animal, and the difficulty of procuring one, may be inferred from the fact, that the cost of the present, from the time that it was taken in the Birman empire, and the charge of its food and conveyance to England, exceeded one thousand pounds.

This rhinoceros was, on its arrival, somewhat more than a year and a half old. It was, however, though so young, (for the rhinoceros is only full grown at twenty years of age,) strong and apparently healthy; yet not the least remarkable were its close points of resemblance to the adult animal, which might not be expected in so young an animal. It has, in miniature, the thick rugous folds or plaits of skin, so conspicuous in the full-grown rhinoceros: and which the older naturalists, with their usual love of marvellous exaggeration, figured as armour, completely encasing the stupendous body.

The height of this young specimen was thirty-one inches, or about that of a good-sized Hampshire hog, to which, when lying down, it had some similitude; but this resemblance was lost when the animal walked about; while it was much stouter and stronger made in the shoulders and legs than a hog, and greatly

* Jameson's Journal, No. 35.

† Entomological Magazine, No. 8.

exceeded in girth any hog of its height; its length, from the extremity of the snout to the insertion of the tail, was 58 inches, and the tail 9 inches; its weight being about 650lbs. The head is long, and the eyes very small: its sight is weak, but its hear-

(The Young Rhinoceros in the Surrey Zoological Gardens.)

ing and sense of smelling are remarkably acute, as it perceives the approach of man at a great distance. That portion of the snout which belongs to the upper jaw is very flexible, can be protruded at will to some extent beyond the jaw, and is thus

particularly formed for collecting food in the manner of the tapir: the lower portion of the snout resembles that of the hog. In adult animals there are no fore-teeth; but in young specimens, like the present, a few straggling cutting teeth are found, which stand at a considerable distance apart. About two or three inches above the snout is a protuberance, the germ of the future horn. According to Mr. Burchell, whose opportunities for examination were abundant, the horns of this genus do not envelope a bony core, like those of the ruminating animals; nor do they partake of the osseous nature of the horns of stags, but appear to be formed of horny fibres growing from the skin, like thick hairs closely cemented together.* The colour of the skin is grey, with a violet tint; it is tuberculated, very hard, and hangs loose about the neck and shoulders; that under the plaits or folds thus formed being of a flesh colour.

The present rhinoceros is quiet and harmless, and will follow its keeper, or any one who offers it bread or biscuit, which it will eat greedily. Its chief food is rice, mixed with sugar, in equal quantities; but it will also eat bran and hay, and seems pleased with prickly plants, and the small branches of thorny shrubs.

A rhinoceros was brought to England twenty years since, and was for a considerable period in the collection of Mr. Cross, of Exeter 'Change; a full-grown specimen, that was on his voyage to this country from Calcutta, a few months since, became so furious that he was fastened down to the ship's deck with part of a chain cable round his neck; and even then he succeeded in destroying a portion of the vessel, till a heavy storm coming on, the rhinoceros was thrown overboard, to prevent the serious consequences of his getting loose in the ship.†

CHANGES OF BIRDS BY CLIMATE.

On Jan. 13, at the Paris Academy of Sciences, a paper was read on this interesting subject by M. Gloyer, of Breslau. It is observed, that in Germany the number of southern birds increase yearly; about 150 years ago, the sparrow was not to be met with in Asiatic Russia. It follows towards the Oby and the Lena the progress of cultivation, and is never seen farther than the line which separates the crops from the barren plains. It is the influence of these alterations that M. Gloyer has studied. According to him, the black colour, or dark brown, becomes darker as the animal approaches the south; lighter towards the north. The grey, or brown grey, remains nearly the same when it is not mixed; but when it is rust colour, or blue grey, or slate

* A specimen of the adult horn, to be seen in the Gardens, measures 1 ft. 10 in. long, and 9 in. diameter at the base; and weighs 14lbs.

† Abridged from the Mirror, No. 658.

colour, it becomes black in the south, or, on the contrary, white if it be mixed with whitish grey. In the north, the grey and the brown grey becomes lighter, or are changed to white. The different shades of rust colour are those which in warm countries have the greatest tendency to deepen and to spread all over the animal. Pink, and the colours which approach it, suffer the least modification. Blue, green, yellow-green, escape almost entirely the influence of climate. The beak and feet undergo similar changes, that is to say, if the colour of the bird becomes darker from the effect of heat, these take also a darker hue. The author remarks, that if the characteristics of blue eyes and fair hair, which antiquity has attributed to the Germans, is no longer so generally found to exist in Germany, this proceeds less from admixture with other races, than from the softening of the climate by cultivation.*

ORGANS OF HEARING IN INSECTS.

By Professor G. R. Treviranus, of Bremen.†

In the posthumous writings of M. Lyonnet, there is given the anatomy of the sheep tick, which belongs to M. Latreille's genus, *Microphthiris.* On the forehead of this animal the author discovered, at the place where the antennæ of insects are usually situated, two oblong protuberances, covering a hole under a double horny scale, in which lay a rounded body on a short footstalk. This projected from a white fleshy substance, composed of a number of globules, very transparent, and rather hard, the footstalk being fixed by a ligament on the interior of the hole. Lyonnet did not, however, come to any definite conclusion respecting the functions of this organ, though it appeared to have a structure analogous to ears.

I believed I had discovered the organ of hearing in the cockroach (*Blatta orientalis*), in the form of an opening, covered by a membrane, white, interiorly concave, and situated at the base of the antennæ. Under it there is a projection from the brain (the first nerve knot, or ganglion), which appears to perform the office of an auditory nerve. The membrane was not round, but semicircular, and immediately bordering on the ring in which the antennæ are fixed. Under it I found a white horny substance, similar to that which covers the inner crustaceous envelope of the head. The projections from the brain appeared to give off nerves to the antennæ on each side; but I could not determine whether it spread out over the membrane, which I am inclined to consider the organ of hearing, as I could not otherwise conceive of its functions.

* Athenæum, No. 329.

† Translated from the German, by Edward Rennie, in the Field Naturalist.

The antennæ of butterflies terminate in a clubbed tip, in which there are not muscles for producing motion, as in the body of these organs, but a half liquid substance filling the cavity. In the alderman butterfly (*Ammiralis Atalanta*), I found this substance intermixed with membranous matter, resembling, in some degree, the substance found in the auditory sacs (*hörsäcken*) of the frog, the calcareous portions being less than in the latter. I think it exceedingly probable that these clubs of the antennæ are the seat of the sense of hearing.

I formerly remarked (*Biologie*, vi., 359), that in the dragon-fly, in the space on the forehead between the eyes and the antennæ, there is a projection covered with a thin membrane, filled with a whitish fluid, which is probably the organ of hearing.

In other winged insects, besides beetles, the interior of the head is large, and destitute of any apparent organ which could serve for the perception of sounds. In the breeze fly (*Tabanus bovinus*), there is, on the upper part of the head, between the two compound eyes, a longish, slender (*schmale*), horny plate; and above this, on the forehead, a small scutiform projection over a hole, between the inner side of the eye, the brain, and the under envelope of the head, continued below, and covered with a very thin, blackish, multiplicate, and uniformly dry membrane. When the head is opened under water, many air-bubbles escape from this hole. Besides small nerves appeared to me to be given off from the further side of the brain to be distributed to this membrane, though I could not make myself certain of this. Rosenthal observed a similar membrane in the flesh fly (*Musca carnaria*); but in this insect there is no external aperture, though air tubes reach it through the scutiform protuberance.

In many yoke-winged flies (*Hymenoptera*), such as bees, there are similar apertures in the head, which probably perform the function of hearing. But it is not, as Ramdohr believed, in that part of the head in bees with which the palpi are joined, that the organ of hearing is situated, as I formerly remarked (*Biologie*, vi., 356). A small sac, indeed, lies there, as I subsequently found; but this is simply one of the air cells.

THE FASCINATION OF BIRDS BY REPTILES

Has often been heard of. A curious instance of it was witnessed by an officer in the Madras army (Lieut.-Col. Ross, then captain in the 10th Native Infantry), where the operator was not a snake, as is usual in such cases, but a crocodile, or, as we improperly call it in India, an alligator. Col. Ross, while taking a stroll round the works at Vellore, had his attention attracted by the strange restlessness and apparent distress of a kingfisher bird (alcèdo smyrnénsis), perched upon one of the pinnacled battlements of the fausse-braye: on his cautiously approaching near enough to ascertain the cause, he observed in the ditch imme-

diately underneath, a crocodile lying perfectly quiet in the water, and intently watching the bird with open jaws: in the meantime the victim's agitation continued to increase: it fluttered down to a projecting point of the works, then rapidly again and again farther and farther down, till at last it actually dropped into the gaping mouth waiting ready to receive it.*

METAMORPHOSIS OF EPHEMERÆ.

On a fine evening, towards the latter end of May, (writes Mr. A. H. Davis,) I was collecting in the neighbourhood of Brixton, near some ponds, when I was suddenly covered by a multitude of a small species of ephemera,—I think the genus cloeon. They settled on me apparently from my being the most conspicuous object near on which to undergo their final transformation. Their colour was of a dusky white, and opaque. They retained their position without moving, enabling me to observe beneath the glass the process by which these fragile creatures withdraw themselves from the comparatively cumbrous garment which envelopes their beautiful and ærial form.

Immediately on settling, the wings were laid flat at right angles with the body, and the insect remained about half a minute in a state of repose. A slight motion then appeared about the bases of the wings, which gradually collapsed, and were drawn alongside the abdomen. At this moment the insect resembled a piece of dirty cotton wool with little form. The elevated portion of the thorax now distended, and then gave way longitudinally, exhibiting the bright brown thorax of the insect, which was rapidly followed by the head and anterior legs. After this effort the insect rested a few seconds. The next discernible motion was in the two or three last segments of the abdomen, where the muscles were in violent agitation, evidently for the purpose of extricating the fine setæ which adorn that part. The contractions continued upward; and the wings, freed from their flimsy covering, were fully developed, and in an instant the delivered captive took its flight; the whole process strongly resembling the drawing off of a tight glove. The whole operation did not, in most cases, exceed three minutes; in some cases less. Scarcely an instant elapsed between the full developement of the insect and its taking flight: so rapidly did they acquire consistency. In some few instances I observed them coupled, in which case they soon died. I made a dozen or so find their way into a phial; they instantly deposited their eggs and died: one only, which I believe was a male, survived when I reached home, less than one hour after.

The number of the insects was truly surprising: they covered every part of my apparel, and my face and hands were not ex-

* Magazine of Natural History, No. 42.

empt. On my arrival at home my hat looked like a miller's, from being completely covered with the exuviæ. I had taken several of these insects during the evening, and had put them into pill-boxes; almost all, however, were immature, and died without undergoing their metamorphosis; from which it would appear, that light and a free atmosphere are essential to its accomplishment. The principal swarm, however, appeared about an hour before sunset, and, I presume, enjoyed their hour's existence in one of the finest sunsets of this glorious summer.

The remarkable, and, I believe, peculiar habit, of the ephemeræ to undergo a quadruple metamorphosis, deserves more notice than it has obtained. The insect appears to possess all the faculties of the perfect insect prior to this last change: it is true it does not fly so readily, and it is apparently of a more yielding matter: if disturbed in this state, although inactive, they will escape. Can any of your correspondents inform me as to the prior state of this tribe, and the characters of the larvæ and pupæ?*

ON THE PIGMENTUM NIGRUM OF THE EYE.

By Thomas Wharton Jones, Esq.

The objects proposed by the author of this paper are,—

1. To correct certain opinions prevalent with regard to the membrane of Jacob, this having been frequently confounded with another, the structure of which forms the immediate subject of the paper.

2. To show that the *pigmentum nigrum* is not a mere mucus or varnish exhaled by the surfaces on which it is found, but is deposited in a membrane distinct from the choroid, which possesses a peculiar structure hitherto unknown. This membrane, being the seat of the pigment, but not the pigment itself, which may or may not be present, the author proposes to call the *membrane of the pigment.*

If a portion of this membrane be examined by the aid of the microscope, it is seen to consist of very minute hexagonal plates, in which are deposited numerous black particles, which are to be considered as properly constituting the pigment, but not essential to the hexagonal plates composing the membrane, because these may, and do, exist without the black particles.

In the eye of the Albino rabbit, the author found, as he had *à priori* expected, the membrane of the pigment to exist. The plates composing which, however, are still less developed than those of that part of the membrane which lies over the tapetum, in the eyes of the horse, ox, &c. They are in fact not hexagonal, but circular, a structure similar to which the author has found in the eye of a very young human fœtus.

* Entomological Magazine, No. 8.

Behind and around the ciliary processes, and on the posterior surface of the iris, the membrane of the pigment ceases to present the hexagonal structure, although still composed of small irregularly rounded masses of about the same size as the hexagonal plates, to which they are evidently analogous.

This change in the structure of the membrance of the pigment, which is only partial in the eyes of the mammiferæ, the author has found to obtain in its whole extent, in the eyes of those animals lower in the zoological scale which he has examined, except in the eye of the cuttlefish, in which there is an approach to the hexagonal structure in that part of the pigment which lies on the posterior surface of the part in which the crystalline lens is fixed.*

PRESERVATION OF CATERPILLARS.

It is, perhaps, to be ascribed to the mode of preserving caterpillars being so imperfectly understood, that they so seldom gain a place in the entomological cabinet. It unfortunately does not appear that Mr. Abbot, (the author of the Lepidopterous Insects of Georgia,) whom Mr. Kirby mentions as having been "remarkable for the admirable manner in which he prepared caterpillars, so as scarcely to differ from life," has recorded the method he pursued. Not being acquainted with any professed entomologists, and, consequently, having only witnessed the plans adopted in the preservation of these creatures in our public museums, I know not whether the following directions may possess aught deserving of attention. If the caterpillar be hairy or spiny, enlarge the orifice of the anus, and from thence endeavour, by gentle pressure, performed with a smooth instrument, to squeeze out as much of the contents of the inside as possible; and while thus operating, let the subject be laid on a sheet of blotting-paper, that the moisture exuded, being imbibed, may be prevented from wetting and spoiling the hairs or spines. This done, insert frequently fresh pieces of dry blotting-paper, rolled round the end of a smooth piece of stick, and continue to do so, until the dryness of the paper, when retracted, indicates that no moisture remains within. Let the skin be now distended into its proper shape, by means of a stuffing of down, or other soft materials, (but not of sand, as recommended in some books,) taking the precaution of guarding against the attacks of destructive insects, by inclosing within a small quantity of camphor, cayenne pepper, and red oxide of lead; ingredients which, for this purpose, I have found very serviceable. In preserving smooth, hairless caterpillars, care must be taken that their colours be not removed by a too rough application of the absorbing instrument. A specimen of the larva of cossus ligniperda, in my possession,

* Proceedings of the Royal Society of Edinburgh.

is partly divested of its reddish tinge, in consequence of its having been grazed internally by the absorber, a circumstance which shows that the colouring matter of this species lies beneath the surface.*

THE LLAMA OF PERU.

We are indebted to the attention of a correspondent in Oban for the following account of the interesting attempt now making in that neighbourhood to domesticate the llama.

I am not surprised that the llamas here should be exciting attention, for they certainly are objects worthy of notice. This animal does not in any shape resemble the sheep of this country; its height is from four to five feet, with long legs and long neck, in some respects not unlike the camel, a small head without horns, the countenance gentle and expressive of wonder. It is not remarkable for any peculiar habits, except that it delights in ascending to the summits of the hills: its appearance indicates an unfitness for climbing: I observe, however, nature has served it with a hooked claw on each hoof, which enables it in some measure to travel heights with as much security as the goat. Their food and treatment differ in no particular from Mr. Stevenson's cows; they graze, eat hay, chopped straw and potatoes, with them daily, and have formed such an attachment to the cows, that when the latter are brought from the hill for the purpose of milking, the llamas will not remain behind, but accompany them to and from the byre three times a day, a distance of half a mile —the wool is extremely fine, each fleece weighing from five to six pounds. Mr. Stevenson imported the first pair (of the Alpacha breed, for there are several varieties,) about three years ago—he tells me that there were four or five pairs shipped for him, but all died during the voyage except the one, and the following year he received another pair of what he terms the real llama, but a common observer cannot discern any difference. They inhabit the mountains of the Andes, and, when domesticated, are used in that country as beasts of burden, chiefly in carrying ore from the mines of Peru, and they carry about 100lbs., and if one pound be added more than they can carry with freedom, like the camel, nothing will impel them forward. If there was any chance of rearing them, they would doubtless become a benefit to the country, but I fear the hope of their breeding is very uncertain.†

INDIAN ANTS.

On August 4, the Secretary of the Entomological Society read a paper by Col. Sykes, on some Indian species of ants, and gave

* Mr. Fennell, in the Entomological Magazine, No. 8.

† The Field Naturalist—February.

some highly interesting particulars of their economy. The descriptions were of three separate species. The first species builds its nest in trees, fixing it with great strength and firmness; the nest itself is nearly globular, about eight inches in diameter, and built entirely of dried cow-dung. The second species (we understood the name to be *indefessus*) exhibits a remarkable instinct very little short of reason. He was accustomed to have his desert placed on a sideboard, near a wall, and left all night, the legs of the sideboard being immersed in vessels of water; notwithstanding which precaution, the sideboard was found in the morning covered with ants, and the sweets were plundered most severely. On seeking the mode in which the intrusion was effected, he found that they got one after another into the water, till a floating living bridge was stretched across it, and then the legs were readily mounted. This mode of access was effectually stopped by a rim of turpentine round each of the legs just above where they entered the water; but the evil was not cured; for, on the following morning, the ants were on the table, and the good things plundered as before; he found that the ants had crawled up the wall in great numbers, and crowded to the part level with the edge of the sideboard, which was not more than an inch from the wall, and so stretched across and obtained a footing, thus running the risk of a fall, which many of them received. The sideboard was now moved quite away from the wall, and for awhile the sweets remained untouched; but soon the usual visitants were again observed, and, for several days, it appeared impossible to account for the intrusion; when, at last, he was standing near the table, and observed a solitary ant climbing quietly up the wall of the room: when it had mounted to rather more than a foot above the level of the sideboard, it took a spring and came down among the sweets: this seemed altogether so extraordinary a proceeding, that he thought it must be the effect of chance; but very soon he saw many other ants make their appearance and mount the wall, like their forerunner, until they reached a certain elevation above the sideboard, when they one and all, without exception, leaped from the wall, *seriatim*, and alighted safely among the sweets: thus their continued appearance was accounted for. The third species was remarkable, as disproving the somewhat absurd theory, proposed by Gould, and almost universally received, that ants do not lay up stores for the winter; a theory which entomologists in particular had fully adopted and entered into. He had seen the ants of this species, in great numbers, carrying the seeds of a grass, which they carried with great care and tenacity to their nests, and laid up in their stores.*

* Entomological Magazine, No. 9.

EFFECTS OF INUNDATIONS ON THE HAUNTS OF SMALL BIRDS.

By a Correspondent of the Field Naturalist.

In the month of August, 1829, the estate of Ballindalloch, in Banffshire, was among others a very great sufferer by the dreadful floods which at that period devastated almost the whole of the north of Scotland. The house was surrounded with water for upwards of eighteen hours; and the garden, pleasure-grounds, and parks, were all either destroyed or very much injured. But what I think most surprising, in connexion with this, was the almost total desertion of the smaller birds which then took place, and was so remarkable as to attract the notice of the most careless observers.

Before this inundation, the chaffinches and house-sparrows in particular, had become so numerous as to be a perfect pest, and nothing in the garden was secure from their depredations. The latter of these birds built in great numbers, not only in holes of the garden wall, and under the eaves of the out-houses, but nestled also on the tops of some lofty silver firs, the summits of which were quite filled with their "straw-built sheds." After the subsiding of the waters, and for the greater part of the season which succeeded this visitation, very few chaffinches, and not a single sparrow, were seen. The former, however, gradually re-returned, and are now nearly as numerous as ever; but of the latter, not one individual, as far as I can learn, has since been noticed, though I have been very assiduous in looking for them myself, and in inquiring of all others who were likely to have observed them. What seems to me to make this still more surprising, is the fact that there is a great extent of wooded bank not a hundred yards from their usual haunts, which was quite beyond the reach of the water, and on an elevated part of which the silver firs grow, in which, as I have already observed, many of their nests were built.

I cannot think that the destruction of the garden is the cause of it, for this reason, that a new one has been formed, at a little distance, no doubt, from its predecessor, but still on a spot, the neighbourhood of which they used formerly to frequent, and in it I have seen numbers of chaffinches, hedge-chanters, redbreasts, and other small birds, but never could distinguish any sparrows among them. All the other grounds near the house have been restored to their former condition, so that no change *on* them can account for it.

FUNCTIONS OF THE BRAIN.

On May 15, a paper was read before the Royal Society, entitled, "Of the Functions of some parts of the Brain; and of the relations between the Brain and Nerves of Motion and Sensation." By Sir Charles Bell, K.H., F.R.S.

The author commences his paper by an enumeration of some of the sources of difficulty and of error which have impeded the progress of discovery in the physiology of the brain; the first impediment to which, he observes, "is in the nature of the inquiry, since extraordinary and contradictory results must be expected from experimenting on an organ so fine as that must be which ministers to sensibility and motion, and which is subject to change on every impression conveyed through the senses." Another cause of fallacy is the dependence of the brain on the condition of the circulation within it: but the most frequent source of error is the obscurity which hangs over the whole subject; for although the brain be divided naturally into distinct masses, not one of these grand divisions has yet been distinguished by its functions; and hence we may account for the failure of all attempts to explain the phenomena which attend injury of the brain. The principle, now universally admitted, that nerves have distinct functions, and not a common quality, is pursued by the author in his investigation of the structure of the brain, in which he follows the nerves into that organ, and observes the tracts of nervous matter from which they take their origin. He concludes from his inquiries, that both sensibility and motion belong to the cerebrum; that two columns descend from each hemisphere; that one of these, the anterior, gives origin to the anterior roots of the spinal nerves, and is dedicated to voluntary motion; and that the other, which, from its internal position, is less known, gives origin to the posterior roots of the spinal nerves, and to the sensitive root of the fifth nerve, and is the column for sensation. He further shows that the columns for motion, which come from different sides of the cerebrum, join and decussate in the medulla oblongata; and lastly, that these anterior and posterior columns bear, in every circumstance, a very close resemblance to one another, in as much as the sensorial expansions of both are widely extended in the hemispheres; for they pass through similar bodies towards the base of the brain, and both concentrate and decussate in the same manner; thus agreeing, in every respect, except in the nervous filaments to which they give origin. Hence he explains the phenomena of the loss of sensibility, as well as the power of motion, of one side of the body, consequent on injuries of the other side of the brain.*

MODE OF KILLING INSECTS.

The plan is simply this:—Take three or four juicy leaves (the younger the better, with, if a more powerful effect is required, a small portion of the tip of the stalk,) of the common laurel; break or cut them into small pieces, and crush them quickly

* Philosophical Magazine, No. 30.

between two stones, in a thin piece of paper; screw up the produce in the latter, with as little exposure to the air as can be avoided, and fix the mass by a pin in a corner of the collecting-box in which the living insects are to be previously placed; keep the box closely shut, and in about five minutes every specimen will have expired. It is necessary that the external air should be excluded, otherwise the fumes of prussic acid, which are evolved from the crushed leaves, will become too much attenuated to affect the respiratory organs of the insects, and the latter will partially revive if too speedily exposed to the vivifying influence of a purer atmosphere. The writer has tried the experiment rather extensively upon insects of various families: *bombi* and *helophili* die very rapidly in less than two minutes, and without any struggling, as is the case when heat, &c. is applied; and moths, in a state of repose, expire without a single previous motion: consequently the process recommended is most admirably adapted for killing the larger *lepidoptera* almost immediately upon their capture, and thus fine specimens may be conveyed home uninjured. The writer has killed a gigantic *epeira diadema* in less than half a minute; and a specimen of *helops cæruleus*, with one or two fresh-captured *philonthi*, at liberty in the box, were also dead when it was opened. He therefore strongly recommends the above process to the notice of the practical entomologist, as being, from its convenience, better adapted for general application than any hitherto proposed.*

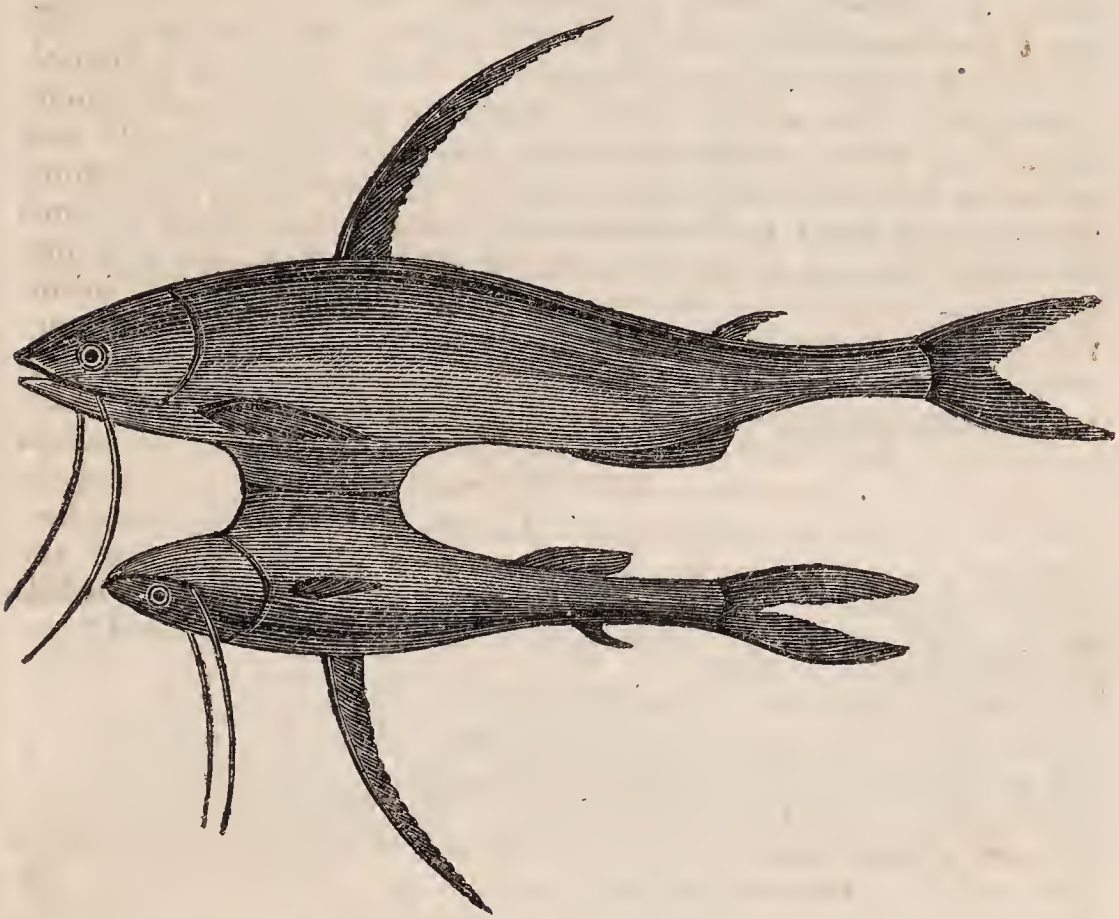
DOUBLE FISH.

By Syl. Churchill.

The annexed drawing represents a pair of cat-fish (a species of Silurus? L.), which were taken alive in a shrimp net, at the mouth of Cape Fear river, near Fort Johnston, North Carolina, in August, 1833, and presented to Professor Silliman. One of them is three and a half, the other two and a half inches long, including the tail,—the smallest, emaciated and of sickly appearance. They are connected in the manner of the Siamese twins, by the skin at the breast, which is marked by a dark streak, at the line of union. The texture and colour, otherwise, of this skin, is the same as that of the belly. The mouth, viscera, &c., were entire, and perfect in each fish; but, on withdrawing the entrails, through an incision made on one side of the abdomen, the connecting integument was found to be hollow, and nothing resisted a flexible probe in passing through from one to the other. This operation was performed with great care, with the tender and soft end of a spear of grass drawn from a green plant. But there was no appearance of the entrails of one having come in contact with those of the other, for the integu-

* Entomological Magazine, No. 9.

ment was less than one tenth of an inch in its whole thickness, and in length from the body, or trunk, of one fish to the other, it was three tenths, and in the water, when the largest fish was in its natural position, the small one could, by the length and pliancy of this skin, swim in nearly the same position. It was not ascertained whether they were of different sexes, or of the same.



(Double Fish.)

When these fish came into existence, it is probable they were of almost equal size and strength; but one "born to better fortune," or exercising more ingenuity and industry than the other, gained a trifling ascendancy, which he improved to increase the disparity, and by pushing his extended mouth in advance of the other, seized the choicest and most of the food for himself. Yet, though he probably hated the incumbrance of his companion, and wished the "marriage *tie* cut asunder," he afforded protection to his "weaker half," and could not *eat it* without *swallowing himself.**

NEW CHAMÆLEON.

On Jan. 21, was read, before the Linnæan Society, the descrip-

* Silliman's Journal, No. 54.

tion of a new species of the genus *Chamæleon*, by Mr. Samuel Stutchbury, A.L.S., Curator of the Bristol Institution.

This new species of *Chamæleon*, to which Mr. Stutchbury has given the name of *cristatus*, from its peculiar dorsal crest, supported by the spinous processes of the vertebræ, — by which character the animal approaches the Basilisks, — is from the banks of the river Gaboon, in the western region of equinoctial Africa, and was presented, along with specimens of other reptiles from the same country, to the museum of the Bristol Institution, by Messrs. King and Son, of that city. The colour of the body is ash-grey, with a dark patch upon the anterior and superior part, giving off inferiorly two or three bands: the posterior part marked with orange and dark-coloured reticulate lines: the edge of the dorsal crest and tail spotted with the same dark colour. Mr. Stutchbury gives the following differential character of the species :—

C. cristatus, superciliari occipitalique carinâ elevatâ et crenulatâ, caudæ anteriori parte dorsique apophysibus elongatis formâ cristæ dorsalis, squamis ferè rotundis subæqualibus.*

INSECTS IN A MUMMY.

On Feb. 3, the Rev. F. W. Hope exhibited to the Entomological Society some insects which had been extracted by Mr. Pettigrew from the skull of a mummy. The skull was on the table: there were several species, principally of Coleopterous genera—*Dermestes Roëi*, *elongatus*, and *pollinctus*; *Necrobia mumiarum*; and a single elytron of *Pimelia spinulosa*, besides the *pupæ* and pupa-cases of two Dipterous insects. Mr. Hope observed, that the oldest specimens of insects with which he was acquainted, were in the museum at Leyden, and the age of these did not, he believed, exceed 150 years; but the specimens he was now exhibiting, had probably been in existence three thousand years. He would not, however, take upon himself to state the precise age of the mummy from which they were taken. Upon this, Mr. Pettigrew mentioned, that the date of the commencement and termination of the practice of embalming is involved in so much obscurity, and extends over so considerable a range of time, that he felt great difficulty in assigning an exact age to any individual mummy. He considered, however, the skull, from which the *Necrobiæ* and *Dermestides* have been taken, to be Græco-Ægyptian, or Pharaonic; it was brought by Mr. Wilkinson, the celebrated Egyptian traveller, from Thebes. Mr. Pettigrew added, "I may observe, however, the practice of embalming was continued as late as the fifth century. As I have this opportunity, I will call your attention to a breast-plate, which I hold in my hand, with a representation of a *Copris*; it was purchased

* Philosophical Magazine, No. 20.

by Belzoni of an Arab, who had taken it from the breast of a mummy; it is of basalt, and carved in alto-relievo. On one side of the *Copris* is a representation of Isis; on the other, of Osiris; and on the reverse are numerous hieroglyphics. Here is another of the same kind of breast-plate, but composed of common pottery instead of basalt; it was purchased by Mr. Rogers, the poet; it bears, like the other, figures of Isis and Osiris, and has also hieroglyphics on the back. I have compared both these with a small tablet of basalt in the British Museum, and have found the figures in all respects the same. I may remark, that the insects exhibited to-night by Mr. Hope, were found in the occipital foramen of the skull. In a skull I have lately examined, there was not the slightest trace of insects, or even of brain; it was perfectly clean; the whole of the brain had been extracted through the left nostril. In another head I found the skull had been fractured; this was evidently the head of a priest. I do not pretend to say how he could come by such rough usage: he had survived this fracture for years; nature had performed a complete cure, by the formation of a layer, or ridge of new bone, along the edges of the fracture, which had firmly united the parts thus unnaturally separated. The cavity of this priest's skull, also, was perfectly clean; not a vestige of the brain remaining. I have omitted to remark, that the hair of the female skull, now on the table, is in perfect preservation,—very long, and, as my daughter tells me, turned up behind in a manner which, curiously enough, happens to be the fashion of the present day, and is called the "three-plait."

The Secretary added, "I think, the insects being found dead, proves that the eggs must have been deposited during the process of embalming."*

SOME ACCOUNT OF THE CHRYSOMELA VITIVORA.

Communicated by Mr. David Thomas, to Silliman's Journal, No. 53.

In the spring of 1831, I first observed these brilliant insects creeping on my vines; and on a closer inspection, I found they were devouring the buds, eating out the central and more succulent parts. Some were advanced even half their lengths into the buds. The exigency required prompt measures; in our first attack, we probably killed a hundred; and we continued our examinations, picking up a few stragglers almost daily, till we had nearly destroyed the colony.

In the spring, they are commonly in pairs. When disturbed, they rather jump than fly, and remain where they fall for a time without motion.

On presenting this insect at that time to a student in Entomology, he pronounced it a *Chrysomela;* and at my request

* Entomological Magazine, No. 7.

furnished the following description. The specific name which he has proposed is indicative of its feeding and living on the vine (*Vitis*). The cuts show the insect, 1. natural size ; 2. magnified.

Chrysomela. Generic character: Tarsi, with four joints; palpi six; antennæ moniliform, thickening towards the tip; thorax margined; body ovate or oblong, convex.

C. *vitivora*. Specific description: Upper surface of the elytra, head, and thorax, of a deep greenish blue ; the under surface of the elytra, the wings, the mouth, and the upper part of the abdomen, brown; the legs, antennæ, and the upper surface of the body, dark green; antennæ the length of the abdomen.

"Inquiries were made of several gentlemen versed in Entomology, whose impressions were, that the insect had not before been described."

It was soon after observed in other parts of Cayuga County: a correspondent informed me that it had been seen near Philadelphia ; and on my inquiring in a horticultural journal, if it had appeared in other places, Noyes Darling, Esq., made the following statement:—

"For New Haven (Con.) and its vicinity, I answer, that this insect made its appearance last spring (1831), but *not*, I believe, for the first time. Its numbers, however, were unusually great ; and the injury which it has done to the vines, is wholly unexampled. Some vines were entirely despoiled of their fruit buds, so as to be rendered, for the present season, barren. An Isabella that bore three hundred bunches the last year, is now destitute of fruit."

I had recollected, that in the preceding season (1830), the vine leaves were infested by a "small, chestnut-coloured, smooth worm;" and in that year (1831), it again appeared on the leaves of my vines ; and also on those which had been visited by the bug, in other places. I suspected that these were the *larvæ* of the C. *vitivora*, and we destroyed all that we could find. By pursuing this course, in the spring of 1832 and 1833, only a few bugs have been detected.

In order to settle the question which had arisen, whether these worms were the *larvæ* of the C. *vitivora*, or not—in the summer of 1832 we put half a dozen of them into a tumbler, with moist earth, and vine leaves, covering it closely. The earth was first carefully examined to see that it harboured no other insect. Fresh leaves were supplied from time to time ; and as the worms became full grown, they passed, one by one, into the earth. After a fortnight or so (for the time could have been exactly determined only by appropriating a glass to each worm), we found in the tumbler three perfect insects of C. *vitivora*.

This experiment, although not so complete as it might have been, seems to leave but little room to doubt the identity of the *supposed* larva with this troublesome insect.

For the information of those who cultivate the vine, that they may be put on their guard against so dangerous an enemy,—most of the foregoing details were published from time to time, in different horticultural journals; and I have now collected and arranged them for the American Journal of Science, in order to inquire if this insect has appeared in more distant parts of the United States, and whether or not it had been previously described and published.

CAPTURING MOTHS.

Mr. Walton has communicated to the *Entomological Magazine*, No. 7, the following method of capturing the moths:—I use a bull's-eye lantern, with a powerful lens,—the larger the better; a pair of forceps, such as are generally used by entomologists, having the sides and bottom covered with white gauze, and about six inches wide at the mouth when opened. Also I use a portable sliding rod, or one with two lengths, jointed like a fishing-rod, from six to nine feet long, and a small round net, made of white gauze or muslin, screwed or fixed on at the end, of about five or six inches diameter, and the same in depth. I then direct the rays of light upon the insect. If it is within reach, I use the forceps, and take it very deliberately; if out of reach, but within the length of the rod, they are easily jarred into the small bag at the end of your rod, lowered down, and transferred into the forceps. In this way they are captured with certainty, and the most surprising facility, principally in consequence of that singular instinctive faculty which many insects possess, in a greater or less degree, of feigning death when alarmed. For example, *Orthosia Pistacini*, and *O. litura*, contract their legs and wings, and fall into the bag-net, or forceps, immediately when touched, tumbling and rolling about without evincing the least signs of life; and so do many others. On the contrary, *O. macilenta*, and *O. flavilinea*, and others, under the same circumstances, exhibit very little, if any, of that predisposition of feigning death. They will try to creep away when disturbed, having no inclination to use their wings, but are easily jarred off the berries or leaves into the bag-net, or induced to creep upon some part of it, until they are finally secured with the forceps. If they happen to miss the net in the act of falling, they invariably drop lightly to the ground, and may be taken from the grass with the forceps. The above observations only apply to the *Noctuidæ*, which carry their wings horizontally; the *Geometridæ*, which carry their wings erect, invariably fly away when touched or disturbed. It requires a little patience and address, when beyond the reach of the forceps, to secure any of this family;

however, they affect death in some degree, and will fall a short distance as if shot, when the rays of light are directed upon them, and the small bag-net held just under them. It is necessary to wait patiently a few seconds, and gently to touch the twig with the ring of your net, until they feel inclined to exercise that shamming propensity; it must then be lowered with care, otherwise, if alarmed or disturbed, the insect will fly out of the bag before you can place over the top the flat side of your forceps. Take the bag-net to some convenient place, and the insect will be seen adhering to the bottom, or sides, with its wings erect. Then place the mouth of the forceps in a vertical position over the circle of the bag-net, and lower it to the ground. This operation will raise up the bottom of the net, and with it the insect, which will fly up into the forceps, and these being closed at the sides, as before directed, it cannot escape.

THE TORPEDO.

On June 19, was read before the Royal Society, "Observations on the Torpedo, with an account of some additional experiments on its Electricity." By John Davy, M.D., F.R.S.

The first part of this paper is occupied by an investigation of the circumstances attending the fœtal developement of the Torpedo. In the first stage of embryonic growth which the author had an opportunity of observing, when the embryo was about seven-tenths of an inch in length, it had neither fins nor electrical organs, nor any appearance of eyes; it exhibited short external branchial filaments, not yet carrying red blood; and there was a red spot in the situation of the heart, communicating by red vessels in the umbilical cord with the vascular part of the egg. There is no membrane investing the fœtus, as is the case with some species of *Squali;* nor any fluid in the uterine cavity; neither could the author find any urea or lithic acid in that cavity. By taking the mean of many observations, it appeared that the weight of the egg, before any appearance of the embryo, is 182 grs., and after its appearance, including the weight of the latter, 177 grs.; while the weight of the mature fish is about 479 grs.; showing an augmentation of more than double. Thus it differs remarkably, in this respect, from the fœtal chick, which, at its full time, weighs considerably less than the original yolk and white from which it is formed. No communication can be traced between the fœtus of the Torpedo and the parent, through the medium of any vascular or cellular structure; and the stomach of the former is always found empty. Hence the only apparent source of nourishment is absorption from the surface; and the author states his reasons for believing that the branchial filaments are the principal absorbing organs, the materials they receive being chiefly employed in the construction of the electrical organs, while those which enter into the composition of the

body generally, are absorbed by the general surface of the fœtus. The author is led, from his researches, to the conclusion that the mode of reproduction in the Torpedo is intermediate between the viviparous and the ovoviviparous.

In the second part of the paper, the author discusses the question as to the number of species of the genus Torpedo existing in the Mediterranean; and concludes that there are only two; viz., the *Ochiatella* and the *Tremola*.*

DISSECTION OF THE EYE OF THE HALIBUT (PLEURONECTES HYPPOGLOSSUS, L.)

By W. C. Wallace, one of the Physicians to the Northern Dispensary, New York.

The eye is oblong. It is every where surrounded by a firm elastic cartilage excepting the cornea and a short space around the entrance of the optic nerve that is occupied by a fibrous covering. Beneath this cartilage there is a considerable quantity of a glairy watery fluid, between it and the next coat, which has a silvery appearance. Within the cartilage, around the entrance of the optic nerve, the ophthalmic artery ramifies into a great number of branches: these pass into a red spongy body nearly surrounding the nerve and at a distance of from two to six lines from it. From this arises a plexus of very minute red vessels which proceed to the circumference of the iris. Some of them go to the completely circular lens and enter at one point on the inner, and at another on the outer side, so that it is poised like a terrestrial globe on its axis. A nerve of considerable size enters with the optic nerve, proceeds along the choroid coat on the inner side to the iris, where it divides into three branches, two of which go to the iris, while the most considerable passes to the lens at its internal axis. The lining membrane of the cornea is reflected over the iris, except at its inferior internal part, where there are different attachments, leaving sufficient space for communication between the anterior chamber and the cavity between the cartilage and the eye-ball, containing what may be termed the aqueous humour.

When the cartilage is compressed, the aqueous humour finds its way into the anterior chamber, and the cornea becomes more convex. When the pressure is removed, the cartilage by its own elasticity resumes its shape, and the cornea by external pressure is flattened. Some of the muscles act upon the transparent cuticle that covers the cornea, and in this way it may be more accurately adjusted.

As there is no appearance of ciliary processes on the anterior edge of the choroid coat, and as in some fishes the spongy body surrounding the nerve very much resembles them when bruised

* Philosophical Magazine, No. 31.

and separated by the fingers, there is reason to believe that it performs a similar office. One use of the ciliary processes seems to be to separate fibrine and other matters from the blood, and thus to prepare it for the formation of the humours. As the lens in fishes is large in proportion to the size of the organ, and very dense towards the centre, the size of the apparatus to prepare its nourishment appears also to be large; and if placed at the anterior edge of the choroid, as in terrestrial animals, it would be disadvantageously situated.*

RAVAGES IN TIMBER OF THE TEREDO NAVALIS AND THE LIMNORIA TEREBRANS.

On the 19th of June last, a paper, of which the following is an abstract, was read before the Royal Society, entitled, "Observations on the *Teredo navalis*, and *Limnoria terebrans*, as at present existing in certain localities of the British Islands." By William Thompson, Esq., Vice-President of the Natural History Society of Belfast.

The opinion which has been advanced, that the *Teredo navalis* is no longer to be found on the British coast, is shown by the author to be erroneous; for numerous specimens of that destructive animal, collected from the piles used in the formation of the pier at Portpatrick, in Ayrshire, were furnished to him by Captain Frayer, R.N. (of his Majesty's steam-packet Spitfire.) Some of these specimens had attained the length of nearly two feet and a half, a magnitude, at least, equal to, if not exceeding, the largest brought from the Indian seas. After giving a description of the animal, the author enters into an inquiry into the agency it employs to perforate the timber which it consumes as food, and in which it establishes its habitation. He ascribes to the action of a solvent, applied by the proboscis, the smooth and rounded termination of its cell, which is afterwards enlarged by the mechanical action of the primary valves.

The author then gives an account of the natural history and operations of another animal, the *Limnoria terebrans*, of Leach, belonging to the class of Crustacea, whose depredations on timber are no less extensive and formidable than the *Teredo*. At Portpatrick, it appears that both these animals have combined their forces in the work of destruction, the *Teredo* consuming the interior, and the *Limnoria* the superficial parts of the wood; the latter continuing its labours until it comes in contact with the shells of the former, so that the whole mass is speedily deprived of cohesion. It is stated, on the authorities of Mr. Hyndman and Mr. Stephen, that the *Limnoria* is already committing great ravages in the timber at Donaghadee.†

* Silliman's Journal, No. 54.

† Proceedings of the Royal Society.

ON ZABRUS GIBBUS.

By the Rev. G. T. Rudd, in the Entomological Magazine, No. 7.

In Vol. I., Part I., pp. 140, 141, of Mr. Stephens's Illustrations of British Entomology, are some remarks "On the supposed Ravages of the Larvæ of *Zabrus gibbus*," and a question is raised as to the food of the perfect insect.

During my residence at Kimpton, near Andover, Hants, an excellent opportunity for investigating this question was afforded me. My curiosity being excited by my friend Mr. Stephens's observations, I gladly and most attentively directed my attention to the inquiry. *Zabrus gibbus* was in profusion at Kimpton, making its appearance generally as the corn came into ear. My brother, Mr. L. Rudd, an indefatigable collecting ally of mine, was on a visit to me in 1828. During one of our rambles, I observed several *Zabri* on the ears of barley, evidently feeding in that situation. I requested my brother to notice most carefully what the beetles were eating; I walked in advance of him some little distance, leaving him to watch the specimen before him. I soon found *Zabrus gibbus* on a barley-stem, eagerly engaged at his repast.

The insect first gnawed off the tip of the husk from the end of the grain, then gradually drew the milky grain out of its sheath, consuming it as it came forth, till the whole grain had disappeared. It repeated the operation, and successively consumed six or seven grains: I then killed, and on my return home, dissected it, when I was most fully satisfied, by this additional proof, that the beetle had fed on the immature corn. My brother knew nothing whatever of my motive for setting him to watch the proceedings of the *Zabrus*, nor even the name of the insect. *His report was minutely the same as mine.* We subsequently paid further and *repeated* attention to the subject (without, however, killing the devourer), and no doubt whatever remained on our minds, that the food of the imago of *Z. gibbus* is the juicy immature grain of barley, and probably, also, of other grain.

ON DEATH.

On Feb. 13 and 20, was read, before the Royal Society, a paper, entitled "An Inquiry into the Nature of Death; being an attempt to ascertain its more immediate causes, with a view to the better regulation of the means of obviating them." By A. P. W. Philip, M.D., F.R.S., L. and Ed.

The object of the present paper, which the author intends as a sequel to those he has lately presented to the Society, and which have been published in the *Philosophical Transactions*, is to investigate the operation of the different causes of death, and the mode in which the several powers of the living system influence each other during the period of their decline. In the more perfect animals, he observes, there are three

distinct classes of functions, namely, the sensorial, the nervous, and the muscular, which have no direct dependence on each other, although they are linked together by the connexions of the organs in which they reside; the consequence of which is, that the cessation of any one class of functions is more or less immediately followed by the destruction of the rest. What is commonly called *death* consists in the extinction of the sensorial functions only; for the nervous and muscular functions may still, for a time, survive; although, in consequence of the failure of respiration, which in the more perfect animals the author considers as, in the strictest sense, a function of volition, they also speedily terminate. Thus he distinguishes this sensorial death from what constitutes actual death, that is, the cessation of all the functions, and which occurs at a later period. As far as the sensorial powers are concerned, their decline and cessation are exceedingly analogous to the approach and occurrence of sleep; the only difference being that the former is an irrevocable failure of those powers, while the latter admits of their being resumed with renovated vigour by the continued action of the vital powers.

The modes in which the sensitive functions are extinguished, or in other words *the forms of death*, are referred by the author to five different heads: the first and only natural mode is that from the simple effect of old age, when all the powers of life are completely exhausted by the continued operation of the agents which had excited them; and death is, in that case, only the last sleep. The vital functions are here impaired, chiefly from the diminished frequency of respiration, which is itself a consequence of the impaired sensibility; so that there is a diminution of the action, but not of the powers, of the vital organs. If the decay of the vital powers be gradual, and nothing occurs suddenly to accelerate it, they will necessarily cease at the time when their excitement is the smallest, that is, during the state of sleep.

In all other cases, death arises from causes which must be regarded as adventitious, and consequently as inducing a more or less violent death. The first class of these causes comprises those arising from the continued action of stimulants, more powerful than the ordinary stimulants to which the system is subjected, and making their immediate impression on the organs of the sensitive system. These may be considered as producing a diseased condition of the sensorium, which, by sympathy, communicates its influence to the vital organs. The next form of death is that which is induced by such causes as are applied, in a sufficient degree, to act as direct sedatives to the organs of the sensitive system, that is, to impair their excitability without previous excitement. The third set of causes of death comprehends those which operate by depriving some of the vital organs of those stimulants on which their functions depend; and the last consists of such as directly debilitate those organs themselves. Thus, according to the author, these adventitious causes act either directly by destroying the power of the brain and spinal cord, or by affecting the vital parts of those organs, so as, through them, to destroy the circulation or the assimilatory functions. The destruction of the circulation appears, in all cases, to be the cause of instantaneous death, and always to be effected through impressions made on the vital parts of the brain and spinal cord, except where the injurious agent operates directly on the organs of circulation themselves.

The author considers the vital functions, together with the muscular and nervous powers, which carry them on, as the results of inanimate agents acting on living parts, or living parts on them; and hence he ex-

plains the analogy which exists between all these functions and the operations of inanimate nature ; while, with regard to the sensorial functions alone, as they are the results of vital parts acting on each other, so no analogy can be perceived between them and those operations.

In the course of the paper the author frequently reverts to the argument, that, to the sentient being, death being simply the loss of sensibility, the last act of dying can in no case be an act of suffering : and in the majority of instances of the long continuance of disease, our tastes, and our relish for life itself, being gradually impaired, death is met, not only with composure, but even with satisfaction.*

NEW GENUS OF ORTHOPTERA.

On Jan. 6, Mr. Newman read, before the Entomological Society, a technical description of *Ripipteryx*, a new genus of Orthoptera. Mr. Newman observed :—The only insect with which I am at all acquainted, that is allied to *Ripipteryx*, is the genus *Tridactylus* of Latreille ; but from this, however, it is sufficiently distinct. Of the economy and history of this latter genus, *Tridactylus*, M. Foudras, of Lyons, has lately furnished us with a most complete and interesting account. In the South of France, it appears that the *Tridactyli* inhabit the sandy banks of large rivers, which in the summer have been left bare by the diminution of the water : as the water retreats they constantly follow it, always keeping within the limits of its moisture, and if grass, or any vegetable, begins to cover the sand with a coat of verdure, instantly quitting it. They form galleries in the sand, in the same manner as mole-crickets ; but what appears most remarkable is, that their food consists of nothing but sand. M. Foudras captured and confined many specimens, and watched them whilst engaged in feeding. He killed and dissected many specimens, and found in the *œsophagus*, and throughout the alimentary canal, no other substance but sand, which was, moreover, the only ingredient of the excrement.†

DISCOVERY OF A MUSCLE IN THE EYE OF FISHES.

Extract of a Letter from W. C. Wallace, to Professor Silliman, dated New York, 16th June, 1834.

I beg leave to announce to you the discovery of a muscle in the eyes of fishes, solving the problem of the accommodation of their eyes to distances in a more satisfactory way, than by a greater or less degree of convexity of the cornea. The muscle is triangular, apparently attached to a nerve at one extremity. Another extremity is attached to the capsule of the lens at its axis. The third passes through a loop in the iris, and is attached to the vitreous humour. The lens is drawn backwards, when the

* Philosophical Magazine, No. 23.
† Entomological Magazine, No. 7.

portion attached to it contracts. When the portion that passes through the loop is called into action, the vitreous humour is pulled forwards, pushing the lens before it. This structure exists in the streaked bass, the sheep-head, the blue fish, the sea-bass, and the poigee: are the only fishes in which I have had an opportunity of looking for it.*

METAMORPHOSIS OF INSECTS.

On April 1, a paper was read on this subject before the Linnæan Society, by Mr. Newman; who refers the whole of the transformations in insects to that tendency to continual decay and reparation observable in all organized beings: and he considers that in this portion of the creation it has become a constant change of skin. Instead of admitting the existence of the four distinct stages of egg, larva, pupa, and imago, he contends that there are only three, that of pupa being frequently wanting; and when it does exist, being merely the matured larva state waiting its final ecdysis. The three states he considers to be these: the egg, or fœtal state; the larva, or adolescent state; and the imago, or adult state. Mr. Newman terms the true or winged insects *tetraptera*, and divides them into these four groups: *tetraptera amorpha*, containing the classes *lepidoptera* and *diptera*, in which the penultimate bears no resemblance to the final state; *tetraptera necromorpha* (*hymenoptera* and *coleoptera*), in which the penultimate resembles the final state, but appears as though dead; *tetraptera isomorpha* (*orthoptera* and *hemiptera*), in which all the states have the same shape and appearance; and *tetraptera anisomorpha* (*neuroptera*), in which the metamorphosis is various.†

CAPTURE OF NYSSIA ZONARIA.

This beautiful and remarkable addition having been made to our British *lepidoptera*, and Mr. Eveleigh, the President of the Banksian Society of Manchester, supposing it to have been an entirely new species, a Correspondent of the Entomological Society has submitted the specimens to the notice of Mr. Stephens, who had never seen any thing like them before. He then applied to Mr. Children, whose entomological library he knew to be unrivalled in this country, and who informed him the insect was the *zonaria* both of Hubner and Duponchel. A single specimen of the male was taken on the rushes about half a mile below Blackrock, near Liverpool, in September, 1832; and about the middle of the same month, in the following year, from twelve to

* Silliman's Journal, No. 54.

† Philosophical Magazine, No. 23.

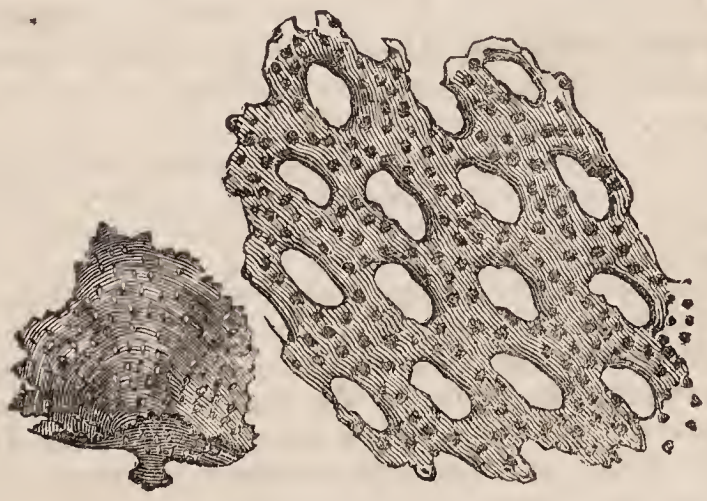
twenty specimens of the same insect, both males and females, were taken in the same locality. The captor is Mr. Nicholas Cook, of Liverpool. The following is a description of the insect:—Antennæ, with the ciliæ black, the shaft white: pilosity of mesothorax very long, dark brown, with two longitudinal white lines, and a dash of white at the base of each wing: body nearly black, with six delicate rings, of a pinkish yellow colour: fore wings brown, with two oblique, transverse, white lines nearly parallel with the exterior margin, and within these are irregular white markings on the disk; hind wings white, with two broad bands, and the nervures brown: legs black, the tarsi annulated with white. The female apterous, with seven rings on the body. The size is, as nearly as may be, that of *N. hispidaria*.*

RETEPORA CELLULOSA.

Dr. George Johnston has figured this curious production in the *Magazine of Natural History*, No. 44.

Synonymes.—Retepora eschara marina *Ellis*, Corall., p. 72. pl. 25. fig. d. D.F.; Millepora Retepora *Pall.*, Elench., p. 243. (exclus. Syn. *Raii* syn.); Millepora cellulosa *Lin.*, Syst., p. 1284; *Turt.*, Lin., iv. p. 637. (exclus. syn. Borl., Cornw.); *Turt.*, Brit. Faun., p. 205; *Stew.*, Elem., ii. p. 427. M. foraminosa *Soland.*, Zooph., p. 138, pl. 26. fig. 2. Retepora cellulosa *Lam.*, Anim. s. Vert., ii. p. 182; *Risso*, l'Europ. Merid., v. p. 343.

Retepora cellulosa has been long known as a production of the Mediterranean, where, says Ellis, it is "found growing to shells and rocks, on the Italian shore, in irregular leafy figures, but very often in the form of a cup or drinking-glass, irregularly expanded at the brim." The British specimen here delineated has something of the latter form, and is about an inch in height, with a breadth of nearly three-quarters: it is affixed by a hollow, thick, and very short stalk, which expands into a shallow cup, with unequal, waved, and sinuous margins. It is pure white, calcareous and beautifully reticulated; the meshes, about a line in length, oval, subequal, regular, and divided by celluliferous spaces rather wider



(Retepora Cellulosa.

* Entomological Magazine, No. 9.

than their own shortest diameter; the cells immersed, quincuncial, leaning, with the apertures looking upwards, a little prominent, round with a small tooth on the distal edge: they open only on the superior or inner aspect; for the under surface of the polypidom is imperforate and almost smooth. Of the polype architects very little is known; but they are said to be "very vivacious," and so industrious in their vocation, that their building rises with a rapidity which has extorted an expression of wonder from several observers.

This, our prettiest zoophyte, may be regarded as a new addition to our native list; for although, in the History of Zoophytes, by Ellis and Solander, it is said that "this elegant little coral is found now and then on our coast;" and we find it introduced into the works of Turton and Stewart, yet the evidence appeared so slight and unsatisfactory, that the Rev. Dr. Fleming has rejected it; influenced, perhaps, by the fact, that the latter naturalists, at least, had confounded it with the Retepora reticulata, figured in Borlase's History of Cornwall.

SHOWER OF FISHES.

On June 15, was read, before the Linnæan Society, an extract of a letter from Mrs. Smith, dated Monradabad, July 20, 1829, to a gentleman in Somersetshire, giving an account of a quantity of fishes that fell in a shower of rain at that place. Many were observed by Mrs. Smith from the window of her residence, springing about on the grass immediately after the storm. The letter was accompanied by a drawing taken on the spot, which represents a small species of *Cyprinus*, $2\frac{1}{4}$ inches in length, green above, silvery white below, with a broad lateral line, bright red.*

POLYPI AND ASCIDIÆ.

On March 6 and 13, was read, before the Royal Society, a paper, entitled "On the Structure and Functions of tubular and cellular Polypi, and of Ascidiæ." By Joseph Jackson Lister, Esq., F.R.S.

This paper contains the account of a great number of observations made by the author during the last summer, while he was at the southern coast of England, on several species of *sertulariæ*, *plumulariæ*, *tubulariæ*, *campanulariæ*, *flustræ*, and other polypiferous zoophytes, and also on various *ascidiæ*. Each specimen was placed for examination in a glass trough with parallel sides, before the large achromatic microscope of the author, directed horizontally; and care was taken to change the sea-water frequently, which was done by means of two syphons, the one supplying fresh water, while the other carried off the old; a plan which succeeded in keeping the animals in perfect health and vigour. The drawings which were taken of the appearances that presented themselves

* Extract from Min. Book of Linn. Soc., vol. xvi., part iii., p. 764.

were traced with a camera-lucida, slid over the eye-piece of the microscope.

In a specimen of the tubularia indivisa, when magnified 100 times, a current of particles was seen within the tube, strikingly resembling, in the steadiness and continuity of its stream, the vegetable circulation in the chara. Its general course was parallel to the slightly spiral lines of irregular spots on the tube; on one side flowing from, and on the other towards, the polypus, each current occupying one half of the circumference of the tube. The particles were of various sizes, some very small, others larger, but apparently aggregations of the smaller: a few were nearly globular, but in general they had no regular shape. At the knots, or contracted parts of the tube, slight vortices were observed in the current; and at the ends of the tube the particles were seen to turn round, and pass over to the other side. Singular fluctuations were also observed in the size of the stomach and of the cavity of the mouth; the one occasionally enlarging, while the other contracted, as if produced by the passage of a fluid from the one into the other and its subsequent recession, thus distending each alternately. This flux and reflux took place regularly at intervals of 80 seconds; besides which two currents were continually flowing, both in the mouth and stomach; an outer one in one direction, and an inner one in the opposite direction.

In all the species of sertulariæ examined by the author, currents of particles were observed passing along the soft substance which occupies the axis of the stem and branches, and were even seen extending into the substance of the polypi themselves, and traversing the stomachs belonging to each. Contrary to what happens in the tubularia, the stream does not, in these animals, flow in the same constant direction; but after moving towards one part for about a minute or two with considerable velocity, it becomes much slower, and then either stops or exhibits irregular eddies, after which it resumes its motion with the same velocity as before, but in the contrary direction; and so on alternately, like the ebb and flow of the tide. If the current be designedly obstructed in any part of the stem, those in the branches go on without interruption, and independently of the rest. It appears from a passage which the author has quoted from Cavolini, that he had noticed the circumstance of currents existing in the interior of sertulariæ, but had not detected their continuation into the stomachs of the expanded polypi. Similar phenomena, which the author describes in detail, were observed in several campanulariæ and plumulariæ; and several particulars are noticed with regard to the ovaries, and to the movements of the fluids contained in the ova of these zoophytes, before their exclusion from the body of the parent. In some cases, the young polype, after it has attained a certain growth, but while still adhering to the parent, becomes decomposed, and, its substance being absorbed into the body of the latter, it entirely disappears. Changes of the same kind frequently take place in different parts of the whole group; one of the polypi being seen to shrink and gradually disappear, while others shoot forth in more luxuriant growth, rapidly acquiring a large size. The author regards the circulating fluids in these animals as the great agent both in the absorption and the growth of parts, and throws out the suggestion, that as it flows into the stomach, it may also act as a solvent to the food received into that cavity. The particles which exist in these fluids show their analogy to those in the blood of the higher animals on the one hand, and to those in the sap of vegetables on the other: some appear to be derived from the digested food, and others

from the melting down of parts absorbed. In these polypi the author never saw the least appearance of cilia, or of currents in the surrounding water, which are so frequently met with in other tribes of zoophytes.

The latter part of the paper is occupied by the account which the author gives of his various observations; first, on ascidiæ, of which he enters into an anatomical description; secondly, on the internal currents of water, permeating the branchial sacs, and determined by the vibratory movements of cilia which are seen in those animals; and, thirdly, on the alternations in the course of the circulation of the blood in the vessels, which at one time flows in one direction, and, after a certain interval, takes the contrary course; so that the same vessel which at one time performs the function of an artery, performs, at another, that of a vein. This phenomenon of alternate currents, like that in the sertularia, was met with in every specimen of ascidiæ which was examined by the author, and also in a polyclinium.

The paper concludes with several observations on flustræ, from which, as far as relates to the circulation of currents, the author was led to results in many respects analogous to the preceding.*

OBSERVATIONS ON SOME OF THE DISEASES IN POULTRY.

By J. M. Coby, Esq., M.R.C.S.

The pathology of birds had been slightly entered upon by Mr. Youatt, the highly talented professor of veterinary medicine at the London University; and it is to be regretted that his researches, which appear to have been confined to more valuable animals, have not been extended in this department. The naturalist may possibly be able to refer to a nosological system in some of the numerous works on zoology, British or foreign; but I am not aware of the existence of any such system. Girard's Anatomie des Animaux Domestiques, 2 vols. Paris, 1820, which is one of the latest foreign works on the structure of domestic animals, does not, I believe, enter upon the subject of pathology.

1. *Cerebral Apoplexy or Stroke.*—The animal, when attacked with this disease, suddenly falls, appears senseless, and is found with the head bent under the neck or thorax. Every time an attempt is made to place it in a sitting or standing position, the head is constantly forced downwards below the breast, the cranium resting on the ground. There is no inclination to take food; and, when it is artificially introduced into the pharynx, it passes onward to the crop. In some instances, death rapidly supervenes; in others, some days elapse, when convulsions in the voluntary muscles appear, and continue till life is exhausted.

This disease is, I believe, always considered to be fatal; but its nature and remote cause are, I apprehend, little known. I believe, in most, if not all, cases, it is occasioned by some vegetable poison, received into the stomach, which has the effect of

* Philosophical Magazine. No. 23.

exciting an engorgement of the vessels of the brain, and a consequent rupture of one of the veins or sinuses of that organ.

On the 31st of August, a fine young hen dropped from her roost almost immediately after she had placed herself upon it. The apoplectic symptoms, above described, were immediately observed; and, at the end of a week, convulsions of the extremities, and of one or both of the larynges (or vocal organs), took place; and, on the eighth day, she died. She was artificially fed and kept warm during the whole illness, and deglutition was completely effected; but the crop had not discharged any of its contents, which had been thus accumulated within it.

On examining the head, I found a rupture of the longitudinal vein or sinus near that part where in the human subject the torcular herophili is situated; and a considerable quantity of coagulated blood was lying in contact with the cerebellum and medulla oblongata, and forced into the mastoid cells. The gizzard was distended with Irish ivy, which had been picked from a wall covered with it, and bounding the poultry yard. On inquiry, I find that ivy is well known to be poisonous to poultry. Its secondary operation on the vascular system of the brain or cerebellum has probably never been suspected.

2. *Emphysema.*—Chickens, when about two weeks or three weeks old, are subject to an emphysematous swelling, a collection of air, under the integuments about the neck, generally preceded by a slight morbid sound in the larynx; and accompanied with vertigo, closing of the eyelids, drooping or convulsive motion of the wings, and coldness of the whole body, which ends in death. This is a different disease from the roup, which is designated by a mucous or mucopurulent discharge from the eyelids, mouth, and nasal passages.

Dissection presents no morbid appearance in the lungs, or injury in the ribs; and the pharynx, œsophagus, gizzard, and the rest of the alimentary canal, are free from disease; except the ileum, the mucous coat of which I have, in some instances, found in a state of softening (or what the French call *ramollissement*), readily admitting of abrasion, occasionally attended with perforations; and, in one case, with black marks on the peritoneal coat, opposite the disease in the internal surface. These black marks arise from a species of disorganization, which is, I believe, peculiar to serous membranes, as I have never observed them in other structures; and, on that part of the intestinal tube being immersed in water a few hours, they disappear, and leave corresponding semiperforations. I have remarked the same appearance in the human intestines, accompanied with a softening and abrasion of the mucous tunic, and a general disease of a specific character affecting the whole serous covering of the abdominal viscera. The other morbid phenomena consists of a softening, erosion, and partial destruction of the spinal marrow, immediately adjoining the medulla oblongata, accompanied with

a considerable effusion of bloody serum, and preternatunal vascularity of the adjacent parts.

The extravasation of air is probably produced by the rupture of one of the axillary or thoracic air cells into which the animal has the power of inflating air from the lungs by means of numerous large tubes resembling the respiratory organs of insects. I am disposed to believe that there exists in these cases a direct communication between the cellular membrane infiltrated with air and the lungs; because, whenever I have punctured the integuments, and produced perfect collapse, the swelling and crackling have been speedily and repeatedly restored. I have not been able to trace the exact source from which the air proceeds, as the cells, even in large birds, are of delicate structure, and, in some, extend from the axilla under the skin along the neck; and, in young poultry, they are still more delicate. I hope to be able to ascertain this point, and to direct my inquiries more particularly to the state of the trachea and inferior larynx.

The morbid condition of the spinal medulla and the adjoining medullary structure is sufficient to account for the paralytic and convulsive affections of the upper extremities; but whether this state may be primary or secondary, appears to me at present uncertain.*

CHANGE OF COLOUR IN THE CHAMÆLEON.

Mr. H. Milne Edwards has contributed to *Jameson's Journal*, No. 34, an ingenious investigation of this phenomenon, concluding with the following results:—

1st, That the change in the colour of chamæleons does not depend essentially either on the more or less considerable swelling of their bodies, or the changes which might hence result on the condition of their blood, or of their circulation; nor does it depend on the greater or less distance which may exist between the several cutaneous tubercles; although it is not to be denied that these circumstances probably exercise some influence upon the phenomenon.

2ndly, That there exists in the skin of these animals two layers of membranous pigment, placed the one above the other, but arranged in such a way as to appear simultaneously under the scarf-skin, and sometimes so that the one may conceal the other.

3rdly, That every thing remarkable in the changes of colour which manifest themselves in the chamæleon, may be explained by the appearance of the pigment of the deeper layer to an extent more or less considerable, in the midst of the pigment of the superficial layer; or from its disappearance underneath this layer.

4thly, That these displacements of the deeper pigment can in

* Magazine of Natural History, No. 44.

reality occur; and it is probably a consequence of them that the chamæleon's colour changes during life, and may continue to change even after death.

5thly, That there exists a close analogy between the mechanism by the help of which the changes of colour appear to take place in these reptiles, and that which determines the successive appearance and disappearance of coloured spots in the mantles of several of the cephalopode mollusca.

ON THE MIGRATORY HABITS OF CERTAIN SPECIES OF HIRUNDO AND SYLVIA.

At a late meeting of the Linnæan Society, there was read a letter, addressed to the Secretary, from Charles Lucien Buonaparte, Prince of Musignano, dated on board the Delaware, near Gibraltar, March 20, 1828, containing some curious facts relative to the migratory habits of certain species of Hirundo and Sylvia. The following are extracts:—"In closing my letter, I happen to think that the following fact may be thought interesting to some of your ornithological gentlemen. A few days ago, being 200 miles from the coast of Portugal, 400 from those of Africa, &c., we were agreeably surprised by the appearance of a few swallows (*Hirundo urbica* and *rustica*). This, however extraordinary, might have been explained by an easterly gale, which might have cut off the swallows migrating from the Main to Madeira, only 200 miles distant from us; but what was my surprise, in observing several small warblers hopping about the deck and riggings. These poor little strangers, exhausted as they were, were soon caught and brought to me. The following is a list of the species:—1. *Sylvia Trochilus;* 2. *Sylvia erithacus*, Lath., (*Tithys*, Temm.); 3. *Sylvia suecica*, or rather a similar species, which I have already received from Egypt and Barbary; 4. A species new to Europe, and, perhaps, even a nondescript, having the plumage of an *anthus*, and which, I think, belongs (as *Sylvia cisticola* and others) to the hitherto African genus *Malurus*. This, however, must rest undecided, my specimen having lost its tail, which had been pulled off by the sailor who caught the bird."*

NEW ANTS.

On March 4, was read, before the Linnæan Society, a paper by John O. Westwood, Esq., F.L.S., on *embia*, a genus of insects allied to the white ants, with the descriptions of three species, one of them, hitherto unnoticed by entomologists, from India, and named embia saundersii, after its discoverer William Wil-

* Extract from the Min. Book of the Linn. Society, vol. xvi., part iii., p. 754.

son Saunders, Esq., F.L.S. The following are the characters of this new species:

E. Lutescenti-fuscescens, incisuris abdominalibus dilutioribus, alis pallidè fuscescentibus, vittis 5 angustissimis albis inter nervos longitudinales positis.

Long. corp. lin. $3\frac{1}{4}$; expans. alar. lin. $5\frac{1}{4}$.

The other two species are E. Savignii, figured by Savigny in the great French work on Egypt (*Neuroptera*, pl. 2, f. 9), and E. Brasiliensis, the olyntha Brasiliensis of Mr. G. R. Gray in Griffith's translation of Cuvier's Animal Kingdom. The author regards these species as constituting the types of three subgenera, distinguished by the number of joints in the antennæ, and the disposition and ramification of the nervures in the wings.*

ON THE STRUCTURE AND USES OF THE MAMMARY GLANDS OF THE CETACEA.

By Professor Traill.

In perusing M. Geoffroy St. Hilaire's interesting fragment on the structure and uses of the mammary glands of the cetacea, it occurred to me that there was an obvious and easy method of ascertaining how far we must admit the distinction attempted to be established by that eminent naturalist, between the process of lactation in terrestrial and aquatic mammalia.

M. Geoffroy St. Hilaire describes the formation of the void within the mouth of the young animal, and the flow of the milk, in the usual manner; but he conceives, that in the act of swallowing, it is essential that the air enter by the nostrils to supply the place of the mouthful of milk that is passing into the stomach. His words are, "Pendant que l'air ambiant, libre désormais de traverser la route des narines, s'en vient remplir l'arrière-bouche, et rendre à la langue et à ses parties accessoires leur premiere aptitude à la deglutition du bol alimentaire," p. 74. The want of this supply of air, he contends, must prevent animals immersed in water from continuing the reiterated efforts of sucking and swallowing without quitting the teat; and he arrives at the conclusion, that, "Le cetacé ne tète donc point."

On reading these remarks, I immedately tried whether I could not suck and swallow with my nose closed; and found that the process was not attended with any difficulty. I also ascertained that the same could be done when the face was immersed in a basin of water.

But in order to render all the circumstances of the experiment as similar as possible to those affecting the lactation of aquatic mammalia, I furnished myself with a bladder, containing half an English pint of milk, and connected it with a short glass tube,

* Philosophical Magazine, No. 22.

surmounted by a cow's teat. I entered a bath, and plunging the apparatus and my whole body below the water, I found that I could suck and swallow, in successive efforts, as readily as in the open air. There was so little difficulty, that, on removing the cow's teat, I sucked up and swallowed all the milk during four immersions, without any violent effort.

When such is the case with man, whose power of submersion rarely exceeds half a minute, why should we doubt that cetecea, accustomed to remain submersed in their own element for a period of not less than fifteen or twenty minutes, without the necessity of respiration, are able to reiterate the action of sucking and swallowing while adhering to the mother's teat?

I may add, that to avoid any accidental chance of error, I was assisted in these experiments by my friend Dr. Cumming, of Chester.*

THE CAPYBARA.

A SPECIMEN of this rare and singular animal has lately been received at the Surrey Zoological Gardens, from South America; it having been taken on the banks of the Amazon, where it is called the river or sea hog. It is a thick-set, clumsy animal, the head and neck singularly large, and is remarkable for being devoid both of the tail and the clavicle, which striking characteristics caused Cuvier to form his genus hydrochærus. Capybaras take up their abode in the extensive forests of South America, near water, concealing themselves in burrows. They swim and dive exceedingly well, and their habits and modes of living strongly resemble those of the beaver. The present specimen is tame and domesticated.

THE FAT-TAILED SHEEP.

THE Sardinian consul at Alexandria in Egypt sent, in 1833, to Turin, a collection of curious animals, rarely met with in Africa. Among the most remarkable of these was a species of sheep, very rare, and quite unknown to the inhabitants even of Egypt. This animal was bought from an Arab, who said it was brought from a district of Arabia which he was not able to indicate with the distinctness which the consul desired. At Turin it came under the notice of M. Gené, professor of zoology in that city, who was at first inclined to think that in its internal structure and peculiar organization, it resembles the ovis steatopyga or kirgisica of Pallas; but when he came to consider it more attentively, he found it to be a species either very imperfectly described or entirely unknown. The most singular feature of the animal is its tail, which may be characterized as monstrous, whether we regard the number and dimensions of the vertebræ,

* Jameson's Journal, No. 34.

or its form and astonishing fatness. When stripped of the fat the form has much resemblance to an S. The fat itself, besides enveloping the tail, which it garnishes to the extremity, is in such abundance that it encumbers and swells up all the posterior parts in a manner to which no verbal description can do justice. Another peculiarity, which gives a most singular aspect to this animal, is a loose drooping skin, not unlike the dewlap of the ox, which extends itself from the angle of the lower jaw to the middle of the neck. The head is of an intense and brilliant black colour, but the rest of the body and the limbs are white, except that a slight tinge of yellow appears on the sinuosity of the tail. The fleece is, to the eye and touch, harsh, coarse, and stiff; but this exterior fleece covers another that is curled, elastic, and of an extraordinary fineness, which would undoubtedly render this species of sheep exceedingly useful. Unhappily, none of those which were brought to Turin were able to survive the winter.*

THE SALMON.

At the third anniversary of the British Association, Professor Agassiz delivered some very interesting observations upon the different species of the genus salmo which frequent the various rivers and lakes of Europe; of which the following is an abstract:—

The genus salmo, as it has been established by Linnæus and Artedi, or, I ought rather to say, by Rondeletius, has supplied Cuvier with the type of a peculiar family, in which he has retained the generic characters of Linnæus, viz. one dorsal fin with soft rays, and a second one, which is rudimental and only adipose. Cuvier places this family in his order malacopterygii abdominales, between the siluridæ and the clupeæ; and he subdivides it, on just grounds, into a great number of generic sections, which comprehend a vast variety of exotic species. In my work on the fishes of Brazil, I have added several new kinds to those which Cuvier established; and am of opinion that, in the natural classification, it is now absolutely necessary to unite the family of the clupeæ to that of the salmones, since the only difference we find between them consists in the presence or absence of an adipose fin; an organ assuredly too insignificant to constitute the distinctive character betwixt two families, and the less so, as there are some genera of the family which possess it, whilst in others it is completely wanting, as for example, in the siluridæ. We may with equal truth affirm, that all the real salmones of Cuvier have not this adipose fin, for in many species of the genera serrasalmus, myletes, &c. it is composed of rays which are truly osseous.

Restricted to the limits which Cuvier has assigned to it, the genus salmo comprehends all the species of which the body is somewhat lengthened, the mouth large, and supplied with teeth, which are conical, pointed, and formidable, implanted into all the bones of the mouth, that is to say, into the interior maxillary bones, both superior and inferior, into the vomer and palate bones, into the tongue itself, and into the

* Printing Machine, No. 7.

branchial arches. The margin of the upper jaw is formed by the interior and superior maxillary bones, and constitutes only a single continuous arch, as in the higher classes of animals; a conformation which, in the class of fishes, is found only in the clupeæ. It is also singular that the number of branchial rays is seldom exactly the same on the opposite sides of the head, the number varying from ten to twelve. The pectoral and the ventral fins are of a middling size; the latter placed about the middle of the belly, opposite to the dorsal; at their base, and along their insertion, there is a fleshy fringe, somewhat similar to the long scales which are found on the most part of the clupeæ. The caudal fin is attached to a very fleshy root, and is moved by very powerful muscles.

This elastic spring is to these fishes a most powerful lever; when wishing to leap to a great height, they strike the surface of the water with a kind of double stroke. By this means they overcome obstacles which appear insurmountable, and leap over nets which are intended to confine them. The most formidable waterfalls can scarcely arrest them. The several species of this genus are found in the northern and temperate regions of Europe, Asia, and America.

The fishes of this family are very ravenous, and feed principally upon the larvæ of aquatic and other insects, and of the small crustacea; they also devour fishes of a smaller size. Their alimentary canal is short, but the stomach is proportionally long and straight. At its pyloric extremity may be observed a great number of appendices, which are connected with the pancreas, and to which is generally, but erroneously, applied the name of cæcum. The swimming-bladder of the whole of them is very large, and opens into the œsophagus near the bottom of the gullet. Though I cannot here enter into the subject very fully, I may in a word state, that I am persuaded that this organ ought to be regarded as the lungs of fishes;—that the circulation of the blood in these animals has been inaccurately interpreted, when it is supposed that in their heart there may be traced a pulmonary course; also, when their branchiæ have been identified with the lungs of other animals; and, finally, when their great dorsal artery has been considered as analogous to the aorta of the mammalia.

Most of the salmon varieties reside in fresh waters; in summer they pay a visit to the sea, and do not mount up again to the rivers, unless for the purpose of there depositing their spawn. It is sufficiently remarkable that most of our species deposit their ova in November and December, and that the young fry of course comes into existence in the coldest season of the year. From this circumstance we may suppose that it is owing to this habit of enduring intense cold in the first days of their existence, that they can subsequently support all that variety of temperature to which they are soon to be exposed.

In proportion as the genus salmo is now circumscribed within its natural limits, so much the more is it difficult to characterize the various species; and I have no fear of being contradicted when I affirm, that since no one has devoted himself to their history, so no one has yet succeeded in determining, with any degree of precision, their distinctive characters. The greatest obstacle to the solution of this problem arises from our ignorance of the accuracy of the characters hitherto employed to distinguish the several species, the one from the other. We have especially attached ourselves to the form of the head, and to the arrangement of the colours; but these two particulars are much too variable to supply precise characters. As to the variation in the colour, we may say

it is infinite. There are, however, two circumstances which especially modify the tints of the salmon tribe, namely, their age, and the season of the year. The younger fish are, in general, much more spotted than the older ones, whose tints become more and more uniform. The salmo hucho, for example, with violet spots more or less distinct, has, when young, large black transverse bands upon the back, down to the middle of its sides. In the second and third years of its existence, these bands break up into black spots, less deep in colour, and they disappear more and more, till in its latter years the fish acquires a colour which is almost uniform. The salmo lacustris of Linnæus, when young, has large black and ocellated spots upon all the superior parts of its body; but from the third year they diminish, and ere long they entirely disappear. The salmo umbla, so long as it is young, is of a uniform greenish-yellow colour, with the abdomen white, and at a later period of life these tints assume a deeper hue—of a more lively green, and finally pass into a blackish-green. The abdomen soon becomes silvery-white, afterwards yellow and orange coloured, and then of a golden lustre. Its flanks are very soon adorned with ocellated yellow spots more or less distinct, but ere long there are no spots at all. In the salmo fario, the spots vary even more. In the young they are found yellow, green, brown, even black and violet, also black and red, but in the long run they all entirely disappear. I have also noticed that the seasons have an influence on the colours of the different kinds of salmo. It is during the autumn, and at the time of the greatest cold, that is to say, in October, November, December, and January, that their tints are most brilliant, and the colours become more vivid by the accumulation of a great quantity of coloured pigments. We might almost say that these fishes bedeck themselves in a nuptial garb, as birds do. The colour of their flesh varies according to the nature of their aliment. This family of fishes feed, as we have said above, especially upon the larvæ of aquatic insects, and of small crustacea. It is in the waters which contain the most of these last, that the most beautiful salmon trout are found. Direct experiments which were made in lakes, have proved, to my satisfaction, that the intensity of the colour of the flesh arose from the greater or smaller quantity of gammarinæ which they had devoured.

As to the structure of the head, it offers, in the opercular bones, in the surface of the cranium, and in its proportions relative to the whole body, very excellent characters; but those, on the other hand, which are taken from the proportional length and size of the jaw-bone, are of no value at all, since the lower jaw is longer or shorter than the upper, according as the fish opens or shuts its mouth; and this consideration introduced into the characteristics of the family, has very considerably contributed to multiply the institution of species. The hook which forms the jaw of the salmo salar is not even a peculiar characteristic of this species, since the full grown males of all the species of the genus present a crooked prolongation of their lower jaw, to a greater or less extent.

It results, then, from these observations, that the different species of the salmo family, far from being confined within the narrow limits of some small bodies of fresh water, are, on the contrary, very widely distributed. They also thrive in all climates, at least in all elevations above the surface of the ocean, whether in fresh water or in salt. It is also true, they prefer those situations where the water is limpid.

Possessed of these facts, which I had collected with the most minute and jealous precautions, I have tried to determine the various species

which are found in the fresh waters of the continent; grounding my examination upon the study of the interior organization, and upon the particulars already determined which the integuments present concerning the structure of the scales. I have also introduced the shape of the body, and the proportional size of its internal parts, as important accessaries to the description of the species. Of course I cannot enter at present into the details of a minute description. This, in fact, is the investigation of which I propose to give an account in my treatise upon the fishes of the fresh waters of central Europe. I must here confine myself to a short statement of the results I have obtained.

It is a very singular fact, that those fishes which are the most widely distributed, and those which are most highly prized, are precisely those whose natural history is the most perplexed. The opinions, too, which are so widely extended concerning their geographical distribution, are not at all in unison with the real state of things. There scarcely exists a country to the which some peculiar species of salmon has not been assigned, and I may add, that even in the regne animal of Cuvier, we find many nominal species, which are not even local varieties, as I propose ere long to demonstrate. The cupidity of the fishermen, the rivalry of epicures, and the fastidiousness of the palate of salmon eaters, have, without doubt, contributed to spread these opinions upon the narrow limit assigned to the haunts of the species of the salmon. There is especially a famous variety, in the annals of epicurism, over which the greatest possible obscurity has been cast,—it is l'ombre chevalier, the char, or alpine trout. After having attentively examined the continental varieties, I with eagerness availed myself of the opportunity I have lately enjoyed, of examining near their native haunts several species of this genus which are found in England. Through the kindness of Sir William Jardine and of Mr. Selby, I have also had an opportunity of examining all those which they have collected from the Scottish lakes; and the result has been, that I have succeeded in determining the perfect identity of many of them with the species found in other countries in Europe; while, on the other hand, I am convinced, by the observations of these naturalists, that there are species peculiar to Scotland.

I am convinced that all the fish belonging to this family, on the continent, may be reduced to the six following species:

1. Salmo umbla, Lin. the char of England,—the ombre chevalier of the Lake of Geneva,—the rötheli of Swiss Germany,—and the schwarz reutel of Saltzburg.

   Synonyms: salmo salvelinus, Lin. Salmo alpinus, Lin. Salmo salmarinus, Lin. (but not the salmo alpinus of Bloch.)

   This fish is found in England and Ireland, in Sweden and Switzerland, and in all the southern parts of Germany.

2. Salmo fario, Lin.—the trout of brooks,—common trout,—gillaroo trout,—and par.

   Synonyms: salmo sylvaticus, Schrank. Salmo alpinus, Bloch. Salmo punctatus, Cuvier. Salmo marmoratus, Cuv. Erythrinus, Lin.

   It is found as extensively as the first species.

3. Salmo trutta, Lin. Sea trout,—salmon trout. It is the same as the salmo lemanus of Cuvier; and the salmo albus of Rondeletius.

   It is found as extensively as the two preceding.

4. Salmo lacustris, Lin. The same as the salmo illanca, and the salmo schiffermulleri of Bloch.

Found in the lakes of Lower Austria, and in the Rhine above Constance.

5. Salmo salar, Lin. The true salmon. The salmo hamatus of Cuvier is the old fish, and the salmo gadeni of Bloch. the young fish.

Found in the Northern Seas, whence it ascends the rivers even as far as the Swiss lakes.

6. Salmo hucho, Lin. Of the same species as the preceding. Peculiar to the waters of the Danube.

It results, then, from these observations, that the different species of the salmon family, far from being confined within the narrow limits of some small bodies of fresh water, are, on the contrary, very widely distributed. They also thrive in all climates, at least in all elevations above the surface of the ocean, whether in fresh water or in salt. Nevertheless, they prefer those situations where the water is limpid.*

SPIDER IN LOGWOOD.

As some sawyers, at the Molyneux logwood-mill, near Prestwick, Lancashire, were engaged in rasping a small block of logwood, they came to a hole in it, from which crawled a large spider, answering very nearly to the description given of the great American spider; and as the logwood comes almost exclusively from Campeachy and the West Indies, it is probably the same. It weighed within a few grains of half an ounce, and the hole which contained it was about six inches and a half in length, and rather more than two in diameter, and in the very heart of the tree. The tree from which the block was sawn was not large, and is supposed to have been under twenty years' growth. It is conjectured that the spider proceeded from an egg which had been deposited in some small hole of the tree, while a sapling. It has been placed in the Museum of Natural History at Manchester.†

STRUCTURE OF FEATHERS.

At the British Association, Sir David Brewster communicated to the Natural History Section a verbal account, which he illustrated by figures, of some curious results which he had obtained respecting the structure of feathers. Dr. Paley and Dr. Roget had, as he mentioned, explained generally the beautiful mechanism by which nature enables the tender fabric of the vane of the feather to resist the action of the air, and to repair itself when divided. By the use of very fine microscopes of garnet and sapphire, Sir David succeeded in developing the minute structures by which the preceding mechanism operates; and he particularly described a singular spring, consisting of a number of

* Jameson's Journal, No. 34. † Printing Machine, No. 18.

slender fibres laid together, all of which resisted the division of the feather or the separation of its fibrils, and which again closed themselves together when their separation had been forcibly effected. He described the difference between down and feather, the former being intended either for ornament or warmth, and the latter for resisting the action of the air when a continued fabric was necessary. These observations were made chiefly on the large feathers from the wing of the vulture; but, generally speaking, the structure is the same in other feathers, though with various modifications. The curious property preserved by the fibrils of hooking themselves together when they had been separated, was mentioned as a singular provision of nature, though the author felt some difficulty in giving a perfectly satisfactory explanation of the manner in which it was effected.*

GUEVI.

A PAIR of these diminutive and beautiful animals, the guevi, or pigmy antelopes, has been added to the menagerie of the Surrey Zoological Gardens. They are the smallest and least known of the whole genus, and have been called the royal antelopes. The only specimen previously brought to England was one in the collection of his late Majesty at Windsor. They scarcely exceed a foot in height; are of an uniform reddish brown colour, with legs not much thicker than a goose-quill; and will bound with ease over a wall twelve feet high. They are brought from Senegal, and are exceedingly mild and gentle in disposition.†

STATISTIC VIEWS OF THE MORTALITY IN VARIOUS COUNTRIES IN EUROPE.

IN considering how limited and few the differences are which exist among the nations of Europe, either in their physical or moral order, it appears at first sight that the laws to which the duration of human life are subjected, cannot experience any very great variations even in the most distant countries. It would be erroneous, however, to believe that it is so; for in the group of European nations who live under the same zone, and whose primitive features are gradually effaced by civilization, mortality experiences as long a series of different terms as in regions inhabited by different races of men, and situated in climates the most opposite to each other.

The causes which affect the movements of the population in Europe, have even a more powerful influence on mortality than on reproduction or births. The greatest is nearly twice as great as that of the least fecundity; whilst, in many districts, the annual amount of deaths is generally three times as much as that

* Literary Gazette, No. 925. † Morning Chronicle.

to which it is limited in some others in proportion to the whole population.

In truth, the most accurate statistical returns which have been drawn up, prove that mortality is reduced in various countries to such a point, that it does not exceed one death in fifty-nine inhabitants; whereas, in many others, it increases annually to one twenty-second part of the population, and still more immensely in times of distress.

On searching in official documents for the number of deaths for several of the latter years, in the principal European states, it is found, that the difference of their mortality, compared with their population, is as follows :—

Table of the Proportion of Deaths to the Population, and of the Annual Mortality among each Million of Inhabitants in the principal States of Europe.

Countries.	Periods or Epochs.	Average number of Deaths.	Ratio of the average Population.	Annual mortality in each million of inhabitants.
Sweden and Norway,	1821 to 1825	79,900	1 in 47 inh.	21,300
Denmark,	1819	33,800	1 .. 45 ..	22,400
European Russia,	1826	960,000	1 .. 44 ..	22,700
Kingdom of Poland,	1829	93,000	1 .. 44 ..	22,700
Britannic Islands,	1818-1821	373,000	1 .. 55 ..	18,200
Netherlands,	1827-1828	163,000	1 .. 38 ..	26,500
Germany Proper,	1825-1828	290,000	1 .. 45 ..	22,400
Prussia,	1821-1826	303,500	1 .. 39 ..	25,600
Austrian Empire,	1828	675,000	1 .. 40 ..	25,000
France,	1825-1827	808,200	1 .. 39 ..	25,600
Switzerland,	1827-1828	50,000	1 .. 40 ..	25,000
Portugal,	1815-1819	92,000	1 .. 40 ..	25,000
Spain,	1801-1826	307,000	1 .. 40 ..	25,000
Italy,	1822-1828	660,000	1 .. 30 ..	33,300
Greece,	1828	33,000	1 .. 30 ..	33,300
Turkey in Europe,	1828	334,800	1 .. 30 ..	33,000
Northern Europe,	. . .	2,972,100	1 .. 44 ..	22,700
Southern ditto,	. . .	2,284,200	1 .. 36 ..	27,800
TOTAL,	. . .	5,256,300	1 .. 40 ..	25,900

According to this table, and many others of a more detailed nature, there annually dies :

1 inhabitant in 28 in the Roman State, and the ancient Venetian provinces ; 1 in 30 in Italy in general, Greece, and Turkey ; 1 in 39 in the Netherlands, France, and Prussia ; 1 in 40 in Switzerland, the Austrian Empire, Portugal, and Spain ; 1 in 44 in European Russia and Poland ; 1 in 45 in Germany, Denmark, and Sweden ; 1 in 48 in Norway ; 1 in 53 in Ireland ; 1 in 58 in England ; 1 in 59 in Scotland and Iceland.

These numbers present the following results:—

The smallest chances of life, and its shortest duration, are not, as one might believe, amongst the effects of the rigorous climate of Norway, or the marshy soil of Ireland; it is in the beautiful climate of Italy that life is reduced to its minimum extent. On the contrary, it is among the icy rocks of Iceland, and in the midst of the eternal fogs of Scotland, where man attains his greatest age.

Of all the European States, the British isles are, in this respect, the most favoured; of each million of inhabitants, they only lose 18,200; whilst the mortality is almost double in the countries washed by the Mediterranean.

Life, next to these, is most certain in Norway and Sweden. *Cæteris paribus*, three people die in the South of Europe, two only, and hardly that, die in ancient Scandinavia. Denmark and Germany enjoy, as it were, similar advantages.

Russia and Poland, where nature and fortune have not been lavish of the necessaries of life, enjoy, however, an astonishing longevity. The population, comprising a mass of nearly sixty millions, spin out their existence almost one-half longer than that which is enjoyed by the inhabitants of Italy, and exactly twice the length of time which any one can expect to live in the capital of Austria.

The average time of life which only cuts off one victim in forty annually, is to be found in the Cantons of Switzerland, the Austrian Provinces, and in the Spanish Peninsula, in consequence of the sun and the dryness of the air.

France, the Netherlands, and Prussia, nearly reach the same term, and will soon get beyond it, unless war, or some other scourge, arrests the progress of their social amelioration.

In the rest of Europe, the mortality amounts to one-thirtieth of the population, and is even frequently increased by accidental causes, which have for a long time endangered the prosperity of the shores of the Mediterranean.

On the whole, we reckon, one year with another, 5,256,000 deaths in 210 millions of people, by a mortality of one-fortieth part, which is unequally distributed among the northern and southern states. The former have only one death in forty-four, the latter, one in thirty-six persons. Of one million of inhabitants in districts situated in the north of France, 22,700 die; 27,000 die in those which lie towards the south. This is a difference of more than 5,000 deaths, equivalent to a two-hundredth part of the population.

If we carefully examine these numbers, and those of the tables of details from which they are extracted, we shall discover that two great causes which predominate over all the others, determine the ratio of mortality to the population, or, in other words, regulate the number of the chances of human life. These are the influence of climate and civilization.

The climate is peculiarly favourable to the prolongation of human life when it is cold, or even rigorous, or when the humidity in the environs of the sea is combined with a low temperature.

The smallest mortality in Europe, occurs in maritime countries which are in the vicinity of the polar circle—such as Sweden, Norway, and Iceland. This is also the case in countries where, as in Russia, the influence of climate is not aided by civilization, and of itself is sufficient to assure long life to mankind.

Countries where the heat is moderate, are not, as might be supposed, among those which possess the advantage of a small mortality; to obtain it, they must acquire the benefits of a high state of social order.

The southern countries, the mild climate of which seems to be so favourable to the human race, are, on the contrary, regions where life is exposed to the greatest dangers. In the smiling plains of Italy, the chances of dying are one-half greater than those of cold and foggy Scotland; and under the beautiful skies of Greece, the certainty of life is one-half less than among the ices of Iceland.

The places of the torrid zone, the mortality of which has been calculated, show the pernicious influence which is exercised over the existence of mankind by a high temperature.

Latitude.					
6° 10′	Batavia,	decrease of 1 in	26½	inhabitants.	Burrow.
10° 10′	Trinidad,	——— 1 —	27	———	Official doc.
13° 54′	St. Lucie,	——— 1 —	27	———	Pugnet.
14° 44′	Martinique,	——— 1 —	28	———	M. de J.
15° 59′	Guadaloupe,	——— 1 —	27	———	M. de J.
18° 56′	Bombay,	——— 1 —	20	———	Transact. Acad.
23° 11′	Havannah,	——— 1 —	33	———	Humboldt.

The resistance of the vital principle in the tropics differs according to the races of men; and its duration in some places is, for the one, double or triple that for the others. The following are examples of this variation :—

Batavia, in 1805—Europeans, 1 in 11 individuals; Slaves, 1 in 13; Chinese, 1 in 29; Javanese, 1 in 46. Bombay, in 1815—Europeans, 1 in 18¼; Mussulmen, 1 in 17½; Parsees, 1 in 24. Guadaloupe, 1816 to 1824—Whites, 1 in 23½; Freedmen, 1 in 35. Martinique, in 1815—Whites, 1 in 24; Freedmen, 1 in 33. Grenada, 1811—Slaves, 1 in 22; St. Lucia in 1802—Slaves, 1 in 20.

We may compare this immense mortality in the torrid zone, with that which occurs in Madeira, the only colonial establishment in the temperate zone. Heberden has calculated, that the deaths in that island were in the proportion of 1 to 49·89 of the whole inhabitants.

The effects that the degree of perfection, more or less exten-

sive, of the social economy, exerts on mortality, are not less extensive than those, the cause of which is to be found in the influence of the climate.

The influence of the progress of civilization is discovered by comparing the ratio of the deaths to the population of the same country at epochs, the intervals of which have been marked by social ameliorations. The following series of universal terms presents an instructive comparison:—

The number of deaths, compared with that of the inhabitants, was,—

In Sweden,	1754 to 1763,	1 in 34,	in 1821 to 1825	1 in 45
— Denmark,	1751 to 1756	1 — 32	— 1819	1 — 45
— Germany,	1788	1 — 32	— 1825	1 — 45
— Prussia,	1717	1 — 30	— 1821 to 1826	1 — 39
— Wurtemberg,	1749 to 1754	1 — 32	— 1825	1 — 45
— Austria,	1822	1 — 40	— 1828 to 1830	1 — 43
— Holland,	1800	1 — 26	— 1824	1 — 40
— England,	1690	1 — 33	— 1821	1 — 58
— Great Britain,	1785 to 1789	1 — 43	— 1800 to 1804	1 — 47
— France,	1776	1 — 25½	— 1825 to 1827	1 — 39½
— Canton of Vaud,	1756 to 1766	1 — 35	— 1824	1 — 47
— Lombardy,	1769 to 1774	1 — 27½	— 1827 to 1828	1 — 31
— Roman States,	1767	1 — 24	— 1829	1 — 28
— Scotland,	1801	1 — 44	— 1821	1 — 59

Thus the mortality has diminished,—

In Sweden, nearly ⅛ in 61 years; in Denmark, 2-5ths in 66 years; in Germany, 2-5ths in 37 years; in Prussia, ⅛ in 106 years; in Wurtemberg, 2-5ths in 73 years; in Austria, 1-13th in 7 years; in Holland, ½ in 24 years; in England, 4-5ths in 131 years; in Great Britain, 1-11th in 16 years; in France, ½ in 50 years; in Canton of Vaud, ⅛ in 64 years; in Lombardy, 1-7th in 56 years; Roman States, ⅛ in 62 years.

For thirty years the mortality has been stationary in Russia and Norway; it has increased in the kingdom of Naples.

On the whole, there has been, for eighty years, a mortality of 1 individual in 36 throughout Europe, according to Süssmilch; our calculations do not exceed 1 in 40, according to the average of later years. On the continent of Europe there has, therefore, been a diminution of one-ninth in the mortality of the aggregate of the people, if we can rely on the German writer on statistics. We are, however, inclined to think, that, during his time, the mortality generally was less than one-thirtieth of the population, which supposes that it is more than one-third less at present in proportion to the augmentation of its population.

This gradual diminution of mortality arises from the same causes in the principal towns of Europe. The number of deaths, compared with that of the inhabitants at distant epochs, gives the following proportions:—

Paris,	in	1650	1 in	25	inhab.;	in	1829	1 in 32
London,	..	1690	1 ..	24	..	..	1828	1 .. 55
Berlin,	..	1755	1 ..	28	..	..	1827	1 .. 34
Geneva,	..	1560	1 ..	18	..	..	1821	1 .. 43
Vienna,	..	1750	1 ..	20	..	..	1829	1 .. 25
Rome,	in	1762-1771	1 ..	21	..	..	1828	1 .. 31
Amsterdam,	in	1761 1770	1 ..	25	..	..	1828	1 .. 29
Cambridge,	in	1811	1 ..	41	..	..	1821	1 .. 58
Norfolk,	..	1811	1 ..	50	..	..	1821	1 .. 59
Manchester,	..	1757	1 ..	25	..	..	1821	1 .. 58
Birmingham,	..	1811	1 ..	30½	..	..	1821	1 .. 43
Liverpool,	..	1773	1 ..	27	..	..	1821	1 .. 41
Portsmouth,	..	1800	1 ..	28	..	..	1811	1 .. 38
Petersburg,	..	1768	1 ..	28	..	..	1828	1 .. 48
Stockholm,	in	1758-1763	1 ..	19	..	..	1827	1 .. 26

The annual mortality has also diminished in Paris, more than $\frac{1}{3}$ in 80 years; in London, more than $\frac{1}{2}$ in 178 years; in Berlin, 1-5th, or nearly $\frac{1}{4}$, in 72 years; in Geneva, 3-5ths in 261 years; in Vienna, $\frac{1}{4}$ in 80 years; in Rome, $\frac{1}{2}$ in 63 years; in Amsterdam, 1-6th in 64 years; in Cambridge, 2-5ths in 10 years; in Norfolk, 1-5th in 10 years; in Manchester, 3-5ths in 64 years; in Birmingham, nearly 2-5ths in 10 years; in Liverpool, $\frac{1}{2}$ in 38 years; in Portsmouth, more than $\frac{1}{3}$ in 11 years; in Petersburgh, nearly 2-3rds in 40 years; in Stockholm, more than $\frac{1}{3}$ in 67 years.*

ANIMAL ORIGIN OF SULPHUR.

Professor C. Gemellaro, of Catania, in Sicily, has started a new theory on the subject of sulphur, the origin of which he attributes to animal substances. From a careful consideration of the nature of this combustible body, and repeated observations on the situations in which it is found, the Professor is led to regard as accidental its presence in volcanoes, in metallic veins, and in mineral waters; and that it is naturally and properly situated in blue clays and tertiary earths, where it is found with gypsum, salt, and lignites. He endeavours to show that where it exists in a pure crystallized form, it has been submitted to the action of subterranean fires. But the most essential point of this theory is, that it proposes to show that sulphur proceeds from the decomposition of the mollusca which remained in the valleys of the secondary earths when the sea retired, during the formation of the tertiary earths. The author does not think his hypothesis destitute of evidence. The existence of sulphur among the principles of the animal kingdom, its analogy with phosphorous, its combustibility, are all characteristics which indicate much rather an organic than a mineral substance. The strong developement of sulphurous hydrogen gas in animal putrefaction, the discovery of pure and crystallized sulphur in

* Abridged from Jameson's Journal, No. 32.

the places where this putrefaction has taken place on a large scale, and many other facts are alleged by Professor Gemellaro in support of his theory, that sulphur has its origin in animal substances.*

INQUIRIES RESPECTING THE WEIGHT OF MAN AT DIFFERENT AGES.

By M. Quetelet.†

The observations of M. Quetelet were made at Brussels, in the Maternal Hospice of St. Peter; he compares them with those made at Moscow and Paris, in similar hospices; and he finds little difference between the means obtained. Unfortunately, the Russian and French practitioners have not distinguished, with as much care as M. Quetelet, the sex, the stature, and the weight of children observed at their birth. This renders the results less capable of comparison. M. Quetelet found for sixty-three male children, and fifty-six female, newly born, the following quantities :—

	Weights.	Stature.
Male Children	7·057536 lbs. Avoird.	1·62732 feet.
Female ——	6·4179468	1·58467

The extremes are :—

	Boys.	Girls.
Minimum	5·1608232 lbs. Avoird.	2·4701376 lbs. Avoird.
Maximum	9·92466	9·36329

The mean weight, without distinction of sex, is 6·7377414 lbs. Avoird. It has been found at Paris, on 20,000 observations, 6·74656332 lbs. Avoird.‡

M. Quetelet has made similar inquiries concerning children from four to twelve years of age, in the schools of Brussels, and in the orphan hospital,—concerning young people in the colleges and in the medical school,—finally, concerning old men in the magnificent hospice which has been constructed in the same city for a period of four years. The results have been completed by observations made upon isolated individuals, taken by chance from the mean of all these data. The author has been able to construct tables, which shows the mean stature, the mean weight, as well as the minimum and maximum, at each age, and for both sexes. These tables show, that there exists at each age, and for each sex, a constant relation between the mean weight and the mean stature, from which the author has constructed another table, more exact than those which result directly from observations on the weights. It follows, from the mean stature formerly

* Printing Machine, No. 8.

† A pamphlet in 4to., of 43 pages. Brussels, 1833.—Translated by the Rev. William Ettershank.

‡ Dictionary of Medical Science.

observed by the author, for the whole population, or, at least, from a number of individuals much more considerable than in these last inquiries, and gives the mean weight corresponding to each stature, according to the observations which make the subject of this memoir.* The following is a table, which we may consider as exact for the whole population of Brussels, and which, for want of a table of this sort, calculated for other countries, may serve, at least, as an approximation for the Caucasian race, and in a temperate climate.

A SCALE OF THE DEVELOPEMENT OF THE STATURE AND WEIGHT.

Ages.	Males.		Females.	
	Stature.	Weight.	Stature.	Weight.
Years.	Imp. Feet.	lbs. Avoirdupois.	Imp. Feet.	lbs. Avoirdupois.
0	1·64045	7·05736	1·60764	6·4179468
1	2·29007	20·841786	2·26382	19·3861692
2	2·59519	25·0101432	2·56238	23·5324716
3	2·83469	27·5023356	2·79532	26·0026092
4	3·04468	31·3839804	3·00102	28·67124
5	3·24153	34·7804194	3·19559	31·6706928
6	3·43511	38·7982752	3·38261	35·28768
7	3·62539	42·984168	3·56305	38·6841192
8	3·81240	45·7857648	3·74351	42 0805584
9	3·99942	49·954122	3·92067	47·1040528
10	4·18314	54·0783696	4·09457	51·8728896
11	4·3636	59·768508	4·26189	56·570562
12	4·54404	65·7674136	4·43905	65·7674136
13	4·72122	75·8244024	4·60310	72·6485112
14	4·89838	85·4844048	4·76714	80·941116
15	5·07227	88·69745824	4·91807	89·035276
16	5·22975	109·5461916	5·03618	96·0927636
17	5·36099	116·559618	5·10179	104·3412588
18	5·43973	127·587018	5·13132	112·5456444
20	5·49222	132·4611288	5·15757	115·3024946
25	5·51191	138·7909564	5·17398	117·5079744
30	5·52503	140·378802	5·18054	119·8237284
40	5·52503	140 4229116	5·18054	121·8086604
50	5·49222	139·9597608	5·03946	123.8597568
60	5·37740	136·074312	4·97384	119·757564
70	5·32490	131·2701696	4·96728	113·6042748
80	5·29219	127·5429084	4·94103	108·884576
90	5·29219	127·5429084	4·93775	108·8183832

* The author cannot consider the results obtained in hospitals and public schools as very exact, as to the mean stature of the population, because inquiries made by him concerning a great number of individuals, have proved to him that the mean stature is a little more among individuals in easy circumstances than in the indigent population, who have recourse to hospices, hospitals, and gratuitous schools.

We see, from this table, 1st, That, at an equality of age, the male is generally heavier than the female; towards the age of twelve years only, an individual of either sex has the same weight. 2ndly, That the male attains the maximum weight about the age of forty years, and that he begins to lose, in a very sensible manner, towards his sixtieth year; that, at the age of eighty years, he has lost about 13·23288 lbs. Avoird., the stature being also diminished 2·75604 inches. 3rdly, That the female attains the maximum weight later than the male, towards the fiftieth year. 4thly, That when the male and the female have assumed their complete developement, they weigh almost exactly twenty times as much as at the moment of their birth, while their stature is only about $3\frac{1}{4}$ times beyond what it was at the same period.

Children lose weight during the three first days after their birth; at the age of a week they begin sensibly to increase; after one year, they have tripled their weight;—then they require six years to double the weight of one year, and thirteen to quadruple it.

To calculate the burden of an edifice, or a bridge, covered with a crowd, it is well to know, that the mean weight of an individual, whatever is the age or sex, is about 98·584956 lbs., that is, 103·65756 lbs. Avoird. for the males, and 93·7328 lbs. Avoird. for the females.

During the developement of individuals of both sexes, we may regard the squares of the numbers representing the weights, at the different ages, as proportional to the fifth powers of the statures. After the complete developement of individuals of both sexes, the weights are almost the squares of the statures.

The weights have varied, in the extremes, among individuals regularly conformed, from 1 to 2, whilst the stature has varied only from 1 to $1\frac{1}{3}$.

The inferior parts of the body are developed more than the superior. In a child, the head is equal to a fifth part; and in a full-grown man, to an eighth of the whole height of the individual. It appears, from a note at the end, that these proportions vary a little among different nations; but M. Quetelet, who, in his preliminary observations, explains very well the importance of these inquiries to the fine arts, does not appear to have written this work purposely for them. The activity which he has exhibited in his researches, makes us believe and hope that he will resume them at another time.*

HINT FOR NATURALISTS.

The fruits of many a naturalist's labours in remote and desolate regions have been lost, in consequence of no means being at

* Abridged from Jameson's Journal, No. 32.

hand of instantaneously stuffing the animals which he has caught. M. Comba, deputy curator to the zoological museum at Turin, has, however, suggested a method, which has at times enabled him to keep birds in a perfect state of preservation, with little trouble, and at no expense. He throws a noose round the bird's head, and after blowing in air through its beak, draws it tight: taking care to press the bird gently during the operation, in order to distribute the air uniformly and properly. Even during the hottest months in the year, this simple process has sufficed to preserve them eight or ten days. Whenever he shot the bird, he inserted wax in the orifice, and continued to press it deeper into it, whilst inflating the animal; this operation was repeated until every wound was so closed.*

THE HEDGEHOG.

One of the most interesting facts in the natural history of the hedgehog is that announced in 1831 by M. Lenz, and which is now confirmed by Professor Buckland. This is, that the most violent animal poisons have no effect upon it; a fact which renders it of peculiar value in forests, where it appears to destroy a great number of noxious reptiles. M. Lenz says that he had in his house a female hedgehog, which he kept in a large box, and which soon became very mild and familiar. He often put into the box some adders, which it attacked with avidity, seizing them indifferently by the head, the body, or the tail, and did not appear alarmed or embarrassed when they coiled themselves around its body. On one occasion, M. Lenz witnessed a fight between the hedgehog and a viper. When the hedgehog came near and smelled the snake, for with these animals the sense of sight is very obtuse, she seized it by the head, and held it fast between her teeth, but without appearing to do it much harm; for having disengaged its head, it assumed a furious and menacing attitude, and hissing vehemently, inflicted several severe bites on the hedgehog. The little animal, however, did not recoil from the bites of the viper; or, indeed, seem to care much about them. At last, when the reptile was fatigued by its efforts, she again seized it by the head, which she ground between her teeth, compressing the fangs and glands of poison; and then devouring every part of the body. M. Lenz says that battles of this sort often occurred in the presence of many persons, and sometimes the hedgehog has received eight or ten wounds on the ears, the snout, and even on the tongue, without appearing to experience any of the ordinary symptoms produced by the venom of the viper. Neither herself nor the young which she was then suckling, seemed to suffer from it. This observation agrees with that of Pallas, who assures us that the hedgehog can eat about a

† Printing Machine, No. 6.

hundred cantharides, without experiencing any of the effects which this insect, taken inwardly, produces on men, dogs, and cats. A German physician, who made the hedgehog a particular object of study, gave it strong doses of prussic acid, of arsenic, of opium, and of corrosive sublimate, none of which did it any harm. The hedgehog, in its natural state, only feeds on pears, apples, and other fruits, when it can get nothing it likes better. Its ordinary food consists of worms, slugs, snails, frogs, adders, and sometimes rats and mice.*

ZOOLOGICAL SOCIETY.

Notes abridged from the Proceedings of the Committee of Science and Correspondence.

THE BARNACLE.

On October 22, 1833, Mr. Gray gave some account of the reproduction of cirrhipeda, founded on observations made by him on balanus cranchii, Leach, during a recent visit to the coast of Devonshire. In illustration of his remarks he exhibited an adult of that species with the eggs attached to the body at the base of the shell, and the young *in ovo*. He also exhibited numerous very minute individuals of Bel. vulgaris affixed to rock.

He described the mode of reproduction as ovoviviparous. On opening under water, after they had been preserved in spirits, the eggs attached to the body of the adult, each was found to contain a perfectly developed animal, which occupied nearly the whole of its cavity. The form of the young barnacle at this period of its existence is ovate, rather tapering above, and truncated and ciliated at the tip: it is furnished with three pairs of arms along the sides, the base of each arm being two-jointed; the lower pair of arms has only one elongated process, while each of the two upper pairs has two fusiform, thick, articulated, and ciliated processes, similar to those of the anterior part of the perfect animal, but less elongated. From the adult it differs chiefly in having a smaller number of feet, and in the less developement of the hinder part. It is also destitute of shelly covering, which is probably not formed until the young animal becomes fixed. In very small attached individuals of the common barnacle the shell is rather soft, transparent, and horn-coloured.

In the absense of shell from the animal in the egg, an additional evidence is furnished of the affinity of the cirrhipedes to crustacea rather than to mollusca: the fœtus in the latter class being covered by a shell at a very early stage of its embryo growth. The existence in the young animal of a smaller number of arms than that found in the adult is also analogous to the corresponding fact which has been observed in several of the branchiopodous crustacea. A similar fact has recently been noticed by Dr. Nordmann as occurring in lernæa.

Mr. Gray remarked that he had been the more induced to call the attention of the society to the subjects which he exhibited, on account of his observations being at variance with those recorded by Mr. J. V. Thompson in the fourth memoir of his "Zoological Researches." The young of balanus is there described as being, when one-tenth of an inch

* Printing Machine, No. 6.

in length, a free swimming animal, resembling cyclops in its general form, and having pedunculated eyes: and it is stated that it then throws off its bivalve-shell-like envelope, together with the greater part of the black colouring matter of the eyes, becomes fixed and covered with calcareous matter, and is changed into a young barnacle, such as is described by Pennant as balanus pusillus, the arms at the same time acquiring the usual ciliated appearance. In Mr. Gray's specimens of the young, on the contrary, the general form of the adult is found, and the arms are ciliated while it is still in the egg, its total length being less than one-fiftieth of an inch. Of this length it is also by no means uncommon to find common barnacles attached.

Mr. Gray added that on examining the eggs which are found around the base of the animals of pentalasmis, Leach, and otion, Ej., he had observed indications of the existence of young similar to the adult. They were not, however, sufficiently developed to enable him to describe them with precision.

Mr. Gray also called the attention of the society to a fact connected with the history of some of the marine gasteropodous mollusca, which he had observed on the same occasion with the young of the balani. It is well known that the animals of terrestrial shells are torpid during the winter in cold and temperate climates, and during the dry season or summer in tropical regions; but it had not been previously remarked that a similar state occurs in those of marine shells. Mr. Gray found that many individuals of littorina petræa, and some of Litt. rudis, were in this condition during his stay at Dawlish. They were attached to the rocks several feet above the reach of the highest autumnal tides; their foot was entirely retracted; and a membranous film was spread between the rock and the edge of the outer lip of the shell: the gills were only moist, the branchial sac being destitute of that considerable quantity of water which exists in it in those of the same species which are adherent to the rock by their expanded foot. In this torpid condition, the individuals observed by Mr. Gray continued during the whole of his stay, which lasted for more than a week. On removing several of them and placing them in sea-water, they recovered in a few minutes their full activity.

Mr. Gray further stated that he had on the same occasion observed that the animal of rissoa parva has the power of emitting a glutinous thread, by which it attaches itself to floating sea-weeds, and is enabled, when displaced, to recover its previous position. A similar property, he remarked, was long since observed in one of the land mollusca, a species of limax, Linn.; and it has recently been recorded by M. Sander Rang as occurring in a marine genus of mollusca, to which he has given the name of litiopa. Mr. Gray added his belief that it would probably be found to be common to many species of marine mollusca.

ADDITIONS TO THE MENAGERY.

Nov. 12.—The Secretary called the attention of the Society to several animals which had recently been added to the menagery. They included an ursine opossum, dasyurus ursinus, Geoff., an animal known to the colonists of Van Diemen's Land by the appellation of the *native devil;* a secretary vulture, gypogeranus serpentarius, Ill., presented to the Society by Lieutenant-General Sir Lowry Cole; and two crowned cranes, presented by the same distinguished officer, on his return from the government of the Cape of Good Hope.

Referring more particularly to the latter, he brought under the notice

of the meeting specimens from the Society's museum of crowned cranes from Northern and from Southern Africa, with the view of illustrating the characters which distinguish as species the birds from these several localities. Their specific distinction, he stated, on the authority of Professor Lichtenstein, had been pointed out, nearly thirty years since, by the Professor's father, who gave to the Cape bird the name of grus regulorum: this distinction has, however, not been generally known among ornithologists, although to those connected with the Society it has for some time been familiar, from observation both of numerous skins and of living individuals. In the bird of North Africa, for which the specific name of pavoninus will be retained, the wattle is small, and there is much red occupying the lower two-thirds of the naked cheeks: in that of South Africa the wattle is large, and the cheeks are white, except in a small space at their upper part: the neck also is of a much paler slate-colour than that of the North African species. He added that the latter characters had been observed to be permanent in an individual presented to the Society, in April, 1829, from the collection of the late Marchioness of Londonderry, and which is still living at the gardens: they exist also in both the individuals presented by Sir Lowry Cole.

The two species may be distinguished as anthropoïdes pavoninus and anthrop. regulorum.

Mr. Gray took occasion to remark that the oval form of the nostrils in the crowned cranes, added to other distinguishing characters which have frequently been pointed out, might be regarded as indicating a generic difference between them and the Demoiselle and Stanley cranes, in which the nostrils have the lengthened form usual in the genus grus, a genus from which they scarcely differ except in the comparative shortness of their bill. For the group, including the crowned cranes, the name of balearica might, he thought, be retained; and that of anthropoïdes be appropriated to the one comprehending anth. virgo, Vieill., and anth. paradisæus, Bechst.

DISSECTION OF A PUMA.

Nov. 12.—Notes by Mr. Martin of a dissection of a *Puma*, *Felis concolor*, Linn., which recently died at the Society's gardens, were read; from which the following are extracts.

Among animals of the feline genus so few points of anatomical difference are found to exist, that the notes of the dissection of one species (allowance being made for relative magnitude,) are closely applicable to that of almost any other. We can, therefore, only expect to trace out minor differences in structure; and these not among organs essentially connected with the habits and general characteristics of the genus, but with habits peculiar and specific. Hence perhaps we find in this group the greatest difference to obtain in the organs of voice; a circumstance which might naturally be expected, as some according modification must necessarily produce the deep-toned roar of the lion, the snarl of the jaguar, and the hissing cry of the puma.

The distance between the base of the tongue and the larynx in the lion, has been brought more than once under the notice of the Society; in the jaguar, this distance, comparatively speaking, is nearly as great; but in the puma, an animal equal, or nearly so, in size to the jaguar, the distance is reduced to an inconsiderable space, an inch or an inch and a half, according as the tongue is more or less protruded. In addition to this, it is worthy of observation, that the circumference of the larynx in

the puma is also very inconsiderable; compare, for example, the larynx of the jaguar with that of the present animal, both natives of the wilds of the American continent. In the jaguar we find a larynx indicating from its general magnitude considerable depth in the intonations of the voice, whereas, in the puma, if we take either its diameter, or its distance from the termination of the palate and base of the tongue, we are led to expect neither the roar of the lion nor the growl of the jaguar, but the shrill tones of an animal, ferocious indeed, but of all others of the genus perhaps the most stealthy and insidious. I am the more inclined to call attention to these differences, because I think that I have observed a kind of mutual correspondence between the voice and the habits of animals, a point well worthy minute investigation, and on which, on a future occasion, I design to offer a few observations.

NEW BAT.

Nov. 26.—Specimens were exhibited of a Bat, which had recently been obtained by the Society from the collection of the late Rev. Lansdown Guilding, Corr. Memb. Z. S.

Mr. Gray, in directing the attention of the meeting to them, remarked on them as constituting the type of a new genus, for which he proposed, on account of the shortness of the nose-leaf, the name of BRACHYPHYLLA.

This genus agrees with *Glossophaga* in most of its characters, and has the same warty-edged slit on the middle of the under lip, and the same elongated tongue: but it differs in the form and structure of the nose-leaf; in the tongue being covered with rough and closely-set warts, which are not placed, as in that genus, in oblique plaits; and in the shape of the central upper incisors, which are elongated and conical, and not short and flat-topped and bevel-edged. In the form of its upper middle incisors it agrees with *Vampyrus soricinus*, Spix; but it is distinguished from that, and from all the other *Vampyri*, by the structure of its under lip and tongue, and by the hinder part of the nose-leaf being separated by a groove from the skin of the forehead. Its interfemoral membrane is somewhat like that of *Vamp. Spectrum*, Geoff., and has the same muscular bands.

This Bat inhabits caves in St. Vincent's, according to the late Rev. Mr. Guilding, who proposed to call it *Vespertilio Cavernarum*.

MANELESS LION OF GUZERAT.

Dec. 10.—The skins were exhibited of a *Lion* and *Lioness* killed in Guzerat by Captain Walter Smee, who, at the request of the Chairman, stated that they were selected from among eleven obtained by him in the same country, eight of which he had brought with him to England. The *Lion* is distinguished from those previously known, by the absence of a mane from the sides of the neck and shoulders, the middle line of the back of the neck being alone furnished with longer hairs, which are erect like those in the same situation in the *Cheetah*, *Felis jubata*, Schreb. The under surface of the neck has long, loose, silky hairs, and there is a tuft at the angle of the anterior legs.

Captain Smee remarked, that the existence in Guzerat of a *maneless Lion* had been known thirty years since by Colonel Sykes, and that Olivier had seen at Bagdad a similar animal, which was understood to have been brought thither from Arabia; but that hitherto, he believed, no skin of such a race had fallen under the observation of naturalists in Europe. Besides the absence of the extensive mane, it has to distinguish

it from the ordinary *Lion*, a somewhat shorter tail, furnished at its tip with a much larger brush.

Regarding it as a strongly marked variety of the *Lion* hitherto known, Captain Smee proposed for it the following characters :—

FELIS LEO, Linn., Var. GOOJRATENSIS. *Jubâ maris cervicali brevi, erectâ ; caudæ flocco apicali maximo nigro.*

Hab. in Guzerat (et in Arabiâ ?) [et in Persiâ ?].

A male measured, including the tail, 8 feet 9½ inches in length. His total weight, exclusive of the entrails, was 4½ cwt.

The *maneless Lion* extends in Guzerat through a range of country about forty miles in length, where it is known as the *Ontiah Baug*, or *Camel Tiger*, a name derived from its colour. In the hot months it is found in the low, bushy, wooded plains that skirt the Sombermutty and Bhardar rivers, from Ahmedabad to the borders of Cutch. It is destructive to cattle, but does not appear to attack man. When struck by a ball it exhibits great boldness, standing as if preparing to resist its pursuer, and then going off slowly, and in a very sullen manner ; unlike the *Tiger*, which, on such occasions, retreats springing and snarling.

Captain Smee entered into various details respecting the animals exhibited by him, comprehending the heads of a paper "On the *maneless Lion* of Guzerat," which he had prepared for the Society.*

THE LION AND THE TIGER.

January 14, 1834.—Several *crania* were exhibited of the Lion and of the Tiger, forming part of the Society's Museum, on which Mr. Owen explained the distinguishing characteristics of that part of the osseous system of these two large species of *Felis*. He adverted, in the first instance, to those pointed out by Cuvier in the "Ossemens Fossiles," and remarked on the first of them,—the straightness of the outline in the Lion from the mid-space of the postorbital processes to the end of the nasal bones, in one direction, and to the *occiput* in the other,—as not being in all cases available : the second distinction,—the flattening of the interorbital space in the Lion, and its convexity in the Tiger,—he regarded as being more constant and appreciable than the one just mentioned. There is, however, a distinction, which he believes has never been published, which is well marked, and which appears to be constant ; for it is found to prevail throughout the whole of the skulls of these animals which he has had opportunities of examining, including ten of the Lion, and upwards of twenty of the Tiger. It consists in the prolongation backwards, in the *cranium* of the Lion, of the nasal processes of the maxillary bones to the same transverse line which is attained by the coronal, or superior ends of the nasal bones : in the Tiger the nasal processes of the maxillary bones never extend nearer to the transverse plane attained by the nasal bones than ⅓rd of an inch, and sometimes fall short of it by ⅔rds, terminating also broadly in a straight or angular outline, just as though the rounded, and somewhat pointed ends, which these processes have in the Lion, had been cut off. Minor differences, Mr. Owen remarked, exist in the form of the nasal aperture, which in the Tiger is disposed to narrow downwards, and become somewhat triangular, while in the Lion its tendency is towards a square shape ; in the deeper sinking, in a longitudinal depression, of the coronal extremities of the nasal bones in the Tiger than in the Lion ; in the bounding of this depression above in most

* In the Philosophical Magazine, No. 23, it is added that a maneless lion also exists in Persia.

of the Tigers' *crania* by a small but distinct semilunar ridge, which is not found in those of the Lion; and in the larger comparative size, chiefly in their transverse diameter, of the infraorbital *foramina* in the Lion. These *foramina*, it is curious to observe, are double either on one or both sides in the only four *crania* examined of Lions which were known to be Asiatic, while in all the others the *foramen* was single on each side.

CAPYBARA—BROWN COATI—MACAQUE MONKEY.

February 11.—Portions were exhibited of the *viscera* of a *Capybara*, *Hydrochærus Capybara*, Erxl., taken from an individual which recently died in the Society's Menagery. They consisted of the stomach, the enormous *cæcum*, and the *fauces*. In calling the attention of the meeting to the latter parts, Mr. Owen availed himself of the opportunity to demonstrate the structure first observed in them by Mr. Morgan, by whom it has been described and figured in the lately published part of the "Linnæan Transactions." The constriction of the hinder part of the soft palate, which prevents any but minutely divided substances from passing into the *pharynx*, and which was first observed in the *Capybara*, is found in many other *Rodents*, but does not obtain in the whole of the animals of that order.

Mr. Martin also exhibited a preparation of aneurism of the *aorta*, obtained from a *brown Coati*, *Nasua fusca*, F. Cuv., sent to the Society for *post mortem* examination by J. H. Lance, Esq. He stated that this disease appeared to be rare among Quadrupeds, no previous instance of it having occurred to him among more than a hundred individuals of various orders which he had dissected within the last few years.

A preparation was exhibited of a young *common Macaque Monkey*, *Macacus cynomolgus*, La Cép., which was born at the Gardens on the morning of the 25th of January, but was dead when first noticed by the keeper. It is the first instance that has occurred in the Society's Menagery of the birth of any Monkey of the Old Continent.

BIRD-CATCHING SPIDER.

Feb. 11.—In a paper on two genera of Spiders, Mr. W. S. Macleay referred to Madame Merian's description of the metamorphosis of *Ur. Leilus*, and to her figure of its *larva*; both of which he regards as unworthy of credit. He then passes to her account of a bird-catching Spider.

The story of a Spider which catches and devours birds, had, Mr. Macleay believes, its origin with Madame Merian. Oviedo, Labat, and Rochefort, make no mention of any Spider as possessing such habits, the two latter writers going no further than the statement, that in the Bermudas there exists one which makes nets of so strong a construction, as to entangle small birds. Madame Merian, however, went the length of asserting that one Spider not only caught, but devoured small birds; and figured the *Mygale avicularia*, Walcken., in the act of preying on a Humming-bird. Now the *Mygale* does not spin a net, but resides in tubes under ground, and in all its movements keeps close to the earth; while Humming-birds never perch except on branches. The food of *Mygale* consists of *Juli*, *Porcelliones*, subterranean *Achetæ*, and *Blattæ*: a living Humming-bird and a small *Anolis*, placed in one of its tubes, were not only not eaten by the Spider, but the latter actually quitted its hole, which it left in the possession of the intruders. The largest Spider of the West Indies that spins a geometrical web is the *Nephila clavipes*,

Leach; and its net may, perhaps, occasionally, be strong enough to arrest the smaller among the Humming-birds: but it is not likely that the Spider would eat the birds. A small species of *Sphæriodactylus*, Cuv., introduced into one of these nets, was enveloped in the usual manner by the Spider; but as soon as the operation was completed, the Spider lost no time in cutting the line and allowing her prisoner to fall to the ground. Mr. Macleay, consequently, disbelieves the existence of any bird-catching Spider.

CRYPTOPROCTA.

February 25.—A letter was read, addressed to the Secretary by M. W. Bojer, Corr. Memb. Z.S., and dated Mauritius, Nov. 15, 1833. It referred principally to the animal from Madagascar, which was transmitted in the spring of last year to the Society by the late Mr. Telfair, and which was brought by Mr. Bennett on April 9, 1833, under the notice of the Society as the type of a new genus, for which he proposed the name of *Cryptoprocta*, on account of its possessing an anal pouch, and being thereby distinguishable from *Paradoxurus*, F. Cuv. One of the habits of the *Cryptoprocta ferox* indicated, during the life of the animal, the existence of this pouch: when violently enraged, and it was apt to become exceedingly ferocious on the sight of a morsel of flesh, "it frequently gratified the persons present with, not an odoriferous, but a most disagreeable smell, very like that of *Mephitis*." Other particulars were contained in the letter, which are given in the "Proceedings."

BIRDS OF NORTH AMERICA.

Feb. 25.—Numerous specimens were exhibited of birds collected in North America, principally in the United States, by George Folliott, Esq., and presented by him to the Society. At the request of the Chairman, Mr. Gould brought them severally under the notice of the meeting. His principal object being to illustrate, so far as these birds were concerned, the geographical distribution of allied or identical species, he directed his observations chiefly to the determination of those North American birds which seemed to him to be referrable to European species, and of those which, having been generally considered as identical with European, appeared, on direct comparison, to present differences in form and colouring.

The common Turnstone of Europe, *Strepsilas collaris*, Temm., appears to be not only identical with the Turnstone of North America, but to be spread, without any tangible variation, over almost every portion of the globe. The Sanderling, *Calidris arenaria*, Temm., and the Knot, *Tringa Canutus*, Linn., are also identical in both continents; as is the great white Heron or Egret, *Ardea Egretta*, Temm. The common Tern or Sea Swallow of England, *Sterna Hirundo*, Linn., occurs equally in North America. The common Crow, *Corvus Corone*, Linn., is also identical in both continents.

With respect to the Whimbrel, *Numenius phæopus*, Temm., and the little Sandpiper, *Tringa Temminckii*, Mr. Gould stated himself to be unable to determine as to their identity without the comparison of more specimens from America than he had yet been able to obtain for the purpose of examination.

The Cross-bill of North America Mr. Gould showed to be very distinct from that of Europe, the *Loxia curvirostra*, Linn.; it is one-third less in all its proportions, and is somewhat less brilliant in colouring.

The Ring Dottrel of North America is also specifically distinct from that of Europe, the *Charadrius Hiaticula*, Linn.; independently of differences in admeasurement, its semipalmated foot will always serve to distinguish it.

In addition to the birds that have been already mentioned, Mr. Folliott's collection contained a series of the *Sylviadæ* of the United States, several Fly-catchers, the *Orphea rufa*, &c. &c.

NEW RADIATED ANIMAL.

Feb. 25.—Mr. Gray exhibited specimens of the shelly covering of a Radiated animal, allied to the *Echinidæ* and the *Asteriidæ*, which he regarded as the type of a new genus, and for which he proposed the name of *Ganymeda*.

This genus is very nearly allied to the fossil described by Dr. Goldfuss, in his beautiful work on Petrifactions, under the name of *Glenotremites paradoxus* (tab. 49, f. 9, and t. 51, f. 1), with which it agrees in external appearance and form, in the possession of a sunken space on its upper surface, and in having only a single inferior pentagonal mouth. It differs from *Glenotremites* by being unfurnished with ambulacra running from the angle of the mouth to the margin, by being unprovided with conical cavities between those near the mouth, and by having in the flattened disc on the back a central quadrangular impression instead of the pentagonal star of that genus.

Dr. Goldfuss described the glenoid cavities on the surface as giving attachment to spines similar to those of the *Turban Echini*, (*Cidaris*, Lam.), and states that the under surface is covered with very small tubercles to which he believes spines were attached. The cavities on the surface of *Ganymeda* and the pits in them have very much the form of those figured by Dr. Goldfuss in his fossil, but I cannot regard them as being fitted for the attachment of spines: they have much more resemblance to the mouths of cells. So great, indeed, is this resemblance, that I entertained doubts whether the whole mass might not be a congeries of cells like the *Lunulites*, rather than the case of a single body, until I considered that it was impossible, from its form, that it could increase in size with the growth of the animal, and that its exceeding regularity proved that it must be the formation of a single creature.

I am induced to consider these two genera, though differing in the above-stated particulars, as forming a family or order between the *Echinidæ* and the *Asteriidæ;* allied to the latter in having only a single opening to the digestive canal, and agreeing with the former in form and consistence, but differing from it in not being composed of many plates.

I only know two specimens of this genus, which I believe were found on the coast of Kent, as I discovered them mixed with a quantity of *Discopora Patina* which I collected several years ago from *fuci* and shells on that coast. The specimens are $\frac{1}{8}$ of an inch in diameter.

I propose to call the species *Ganymeda pulchella*.

NEW TORTOISE.

March 11. — Specimens and drawings were exhibited of a fresh-water tortoise, forming part of the collection of Mr. Bell, by whom it was described as the type of a new genus, for which he proposed the name of *Cyclemys*.

Mr. Bell regards this tortoise as supplying a link in the connecting series of the land with the fresh-water families which has hitherto been

wanting; and as especially valuable in the natural arrangement, by the clue which it furnishes to the correct location of the Indian forms of the genus *Emys*. It is, indeed, most nearly related to *Emys spinosa*, and on a superficial observation might almost be referred to that species; but on closer examination it is found to differ from that Tortoise, not only specifically, but generically also: its sternal bones are permanently separated from the dorsal ones, with which they are connected by means of a ligament alone, similar to that which performs the same office in *Terrapene*. From the Box-Tortoises, however, to which, in this point of its structure, it is so closely related, *Cyclemys* is altogether distinct, the whole of its *sternum* being entire, instead of having, as is invariably the case in *Terrapene*, one or more transverse divisions of the *sternum* itself, the lobes of which move as on a hinge. In *Terr. Europæa* this mobility of the *sternum* exists in each lobe in a small degree, combined with the ligamentous connexion of the sternal to the dorsal bones. In *Cyclemys* the whole *sternum* moves together, though very slightly.

The transition from the land to the fresh-water Tortoises may consequently be regarded as commencing in *Terrapene;* passing through *Terr. Europæa* to *Cyclemys orbiculata;* and thence through the Indian forms of *Emys*, which so closely resemble the latter species, to the other forms of *Emys:* the natural series of connexion between the *Testudinidæ* and the *Emydidæ* being thus completed.

MUSK DUCK.

March 11.—A specimen was exhibited of the Musk Duck of New Holland, *Hydrobates lobatus*, Temm. It had recently been presented to the Society by Lieut. Breton, R. N., Corr. Memb. Z. S., who entered into some particulars respecting its habits. He stated that these birds are so extremely rare, that he saw only three of them during his various excursions, which extended over twelve hundred miles of country. He has never heard of any instance in which more than two were seen together. They are met with only on the rivers, and in pools left in the otherwise dry beds of streams. It is extremely difficult to shoot them, on account of the readiness with which they dive; the instant the trigger is drawn, the bird is under water.

INSECTS OF GUIANA.

March 11.—Some observations by Dr. Hancock on the Lantern-fly, and other Insects of Guiana, were read. The writer concurs with M. Richard and M. Sieber in regarding as erroneous the statement of Madame Merian, that the Lantern-fly, *Fulgora lanternaria*, Linn., exhibits at night a brilliant light, and remarks that the whole of the native tribes of Guiana agree in treating this story as fabulous: it seems to be an invention of Europeans desirous of assigning a use to the singular diaphanous projection, resembling a horn lantern, in front of the head of the insect. He also states that the *Fulgoræ* rarely sing.

The insect whose song is most frequently heard in Guiana is the *Cicada clarisona*, the *Aria-aria* of the Indians, and *Razor-grinder* of the colonists: in the cool shade of the forests it may be heard at almost every hour of the day: but in Georgetown its song commences as the sun disappears below the horizon. At Georgetown this *Cicada* was never heard in 1804, when Dr. Hancock first visited the place; but it is now very common, probably in consequence of the shelter afforded by the growth of many trees and shrubs in the gardens which have since

been formed there. The sound emitted by it is "a long, continuous, shrill tone, which might be compared almost to that of a clarionet, and is little interrupted, except occasionally by some vibrating undulations."

ALBATROSS.

March 25.—A specimen was exhibited of an Albatross, presented to the Society by Lieut. Breton, Corr. Memb. Z. S., whose principal object in calling the attention of the Society to it was to mention that, being unprovided at the time at which the bird was killed with any of the ordinary preserving powder or soap, he had used for its preservation a mixture of Cayenne and black peppers, with snuff and salt. The skin, well rubbed with this mixture, was brought through the intertropical regions in an ordinary trunk, affording free access to insects, and arrived in England uninjured. Lieutenant Breton conceives that it may be advantageous to collectors to be made aware that the preservation of skins can be secured by articles so constantly at hand as those which he employed in this instance.

EXTRAORDINARY TORPIDITY.

March 25.—A note was read from Mr. Gray, giving an account of the arrival in England of two living specimens of *Cerithium armatum*, which had been obtained at the Mauritius, and had been brought from thence in a dry state. That the inhabitants of land Shells will remain alive without moisture for many months is well known: he had had occasion to observe that various marine *Mollusca* will also retain life in a state of torpidity for a considerable time, some facts in illustration of which he had communicated at a recent meeting of the Society: the present instance included, however, a torpidity of so long a continuance as to induce him to mention it particularly. The animal, though deeply contracted within the shell, was apparently healthy and beautifully coloured. It emitted a considerable quantity of bright green fluid, which stained paper of a grass green colour: it also coloured two or three ounces of pure water. This green solution, after standing for twelve hours in a stoppered bottle, became purplish at the upper part; but the paper retained its green colour though exposed to the atmosphere.

The Secretary mentioned an instance of the arrival in this country of a living *Cerithium Telescopium*, Brug., brought from Calcutta, in company with some small *Paludinæ*, which also reached England alive: these *Mollusca* were, however, kept in sea water frequently changed. It is worthy of remark, that the spirit in which this animal was immersed for the purpose of killing it, and in which it was kept for some weeks, became of a dark, verdigris colour.

The following note by Mr. Benson relative to the importation of the living *Cerithium Telescopium*, Brug., here adverted to, was read on August 12.

"The possibility of importing from other countries, and especially from the warmer latitudes, the animals which construct the innumerable testaceous productions that adorn our cabinets and museums, the accurate knowledge of which is so necessary to enable the conchologist rightly to arrange this beautiful department of nature, must be an interesting subject to every naturalist, and will render no apology necessary for the following notices extracted from my journal. Their publicity may incite others, who may have opportunities of trying the experiment, to follow the example.

"January, 1832.—Observed near the banks of the canal leading from the eastern suberb of Calcutta to the Salt Lake at Balliaghát, heaps of a *Cardita* with longitudinal ribs, of a large and thick *Cyrena*, and of *Cerithium Telescopium*, exposed to the heat of the sun for the purpose of effecting the death and decay of the included animals previously to the reduction of the shells into lime.

"Early in the month I took specimens of them, and leaving them for a night in fresh water, I was surprised to find two *Cerithia* alive. I kept them during a fortnight in fresh water, and on the 22nd of January carried them, packed up in cotton, on board a vessel bound for England. After we had been several days at sea, I placed them in a large open glass with salt water, in which they appeared unusually lively. I kept them thus, changing the water at intervals, until the 29th of May, when we reached the English Channel. I then packed them up, as before, in a box, and carried them from Portsmouth to Cornwall, and thence to Dublin, which I did not reach until the 14th of June; here they again got fresh supplies of sea water at intervals. One of them died during a temporary absence between the 30th of June and the 7th of July; and on the 11th of July the survivor was again committed to its prison, and was taken to Cornwall, and thence to London, where it was delivered alive to Mr. G. B. Sowerby, on the 23rd of July.

"This animal had thus travelled, during a period of six months, over a vast extent of the surface of the globe, and had, for a considerable portion of that time, been unavoidably deprived of its native element."

ORNITHORHYNCHI.

March 26.—Dr. Weatherhead exhibited two young *Ornithorhynchi* preserved in spirit, which he had recently received from New Holland, and stated his intention of presenting one of them to the Society's Museum. The smallest of them is about two inches in length; the largest about four. Both are destitute of hair; and in both the eye-lids are closed. In the smaller one there is a vestige of an umbilical slit.

The larger of the two is one of those which were kept in captivity, with their dam, by Lieutenant the Hon. Lauderdale Maule, as noticed in a communication read at the meeting of the Committee of Science and Correspondence of this Society, on September 11, 1832. With it was exhibited the dried skin of the dam, to which the mammary glands, largely developed, had been left adhering.

PORCUPINE ANT-EATER OF NEW HOLLAND.

March 11.—A note from Lieutenant Breton, Corr. Memb. Z. S., was read, giving an account of an *Echidna*, which lived with him for some time in New Holland, and survived a part of the voyage to England. The animal was captured by him on the Blue Mountains: it is now very uncommon in the colony of New South Wales. He regards it as being of its size the strongest quadruped in existence. It burrows readily, but he knows not to what depth.

Previously to embarkation, this individual was fed on ant-eggs and milk, and when on board, its diet was egg chopped small with liver and meat. It drank much water. Its mode of eating was very curious, the tongue being used at some times in the manner of that of the Chamæleon, and at others in that in which a mower uses his scythe, the tongue being curved laterally, and the food, as it were, swept into the mouth: there seemed to be an adhesive substance on the tongue, by which the food was

drawn in. The animal died suddenly off Cape Horn, while the vessel was amidst the ice; perhaps in consequence of the cold, but not improbably on account of the eggs with which it was fed being extremely bad.

Lieutenant Breton agrees with MM. Quoy and Gaimard, in believing that little difficulty would be experienced in bringing alive to Europe the *Echidna*, or *Porcupine Ant-eater* of New Holland.

LONG-TAILED MANIS.

April 22.—Mr. Thompson, of Belfast, exhibited an immature specimen of the *long-tailed Manis, Manis tetradactyla*, Linn., for the purpose of showing, that when very young (the present specimen being but ten inches in length), the animal is as thoroughly armed, both with respect to scales and spines, as the full-grown one. The specimen was also considered by Mr. Thompson as interesting on account of its locality, it having been obtained in Sierra Leone.

HUMMING-BIRDS.

May 13.—A Note was read from Mrs. Barnes, in which it was stated that that lady had brought up from the nest two of the smallest species of Jamaica Humming-birds. They were so tame, that at a call they would fly to her, and perch upon her finger. Their food was sugar and water. During the passage to England, one of them was killed by the cage in which they were kept being thrown down in a storm; its companion drooped immediately, and died shortly afterwards.

It was remarked that injury to the bird in consequence of such an accident might be prevented by the introduction of a gauze-net screen into the cage, at some little distance within the wires.

PARADOXURUS.—HORNED PHEASANTS.

Specimens were exhibited of several *Mammalia* from India, which had recently been presented to the Society by Lord Fitzroy Somerset. They were brought under the notice of the meeting by Mr. Bennett, who called particular attention to the skin of a *Paradoxurus*, which he regarded as that of *Par. prehensilis*, Gray, a species hitherto known only by a drawing of Dr. Hamilton's preserved in the East India House.

The general colour of the animal is a pale greyish brown, in which longer black hairs are sparingly intermixed on the sides. On the back of the head and neck, and along the middle line of the back, these black hairs are almost the only ones that are visible. On the loins they form three indistinct black bands, of which the lateral are in some measure interrupted. The head is brownish, with the usual grey mark both above and below the eyes, and there are some short grey hairs between the eyes and across the forehead. The limbs are brownish black, rather darker towards their upper part. The tail, at its base, is of the same colour as the back, and rapidly becomes black; its terminal fifth is yellowish white. The ears are rather large, and sparingly covered with short brownish hairs.

Specimens were exhibited of three species of horned Pheasants, including the *Tragopan Temminckii*, Gray. In illustration of the history of the latter bird, Mr. G. Bennett, Corr. Memb. Z. S., placed upon the table drawings of specimens observed by him at Macao, and showing the remarkable wattle in various degrees of developement. He also read a note on the subject.

In its contracted state, the membrane has merely the appearance of a purple skin under the lower mandible; and it is even sometimes so much diminished in size as to be quite invisible. It becomes developed during the early spring months or pairing season of the year, from January to March, when it is capable of being displayed or contracted at the will of the bird. During excitement, it is enlarged, falls over the breast, and exhibits the most brilliant colours, principally of a vivid purple, with bright red and green spots: the colours vary in intensity according to the degree of excitement. When they are most brilliant, or, in other words, when the excitement is great, the purple horns are usually elevated. The living specimens seen by Mr. G. Bennett were procured from the province of Yunnan, bordering on Thibet. Mr. Beale, in whose aviary at Macao they were, had not succeeded in obtaining females of this race. Its Chinese name is *Tu Xou Nieu*.

THE KING PENGUIN.

May 13.—Mr. G. Bennett read a note on the habits of the King Penguin, *Aptenodytes Patachonica*, Gmel., as observed by him on various occasions when in high southern latitudes. He described particularly a colony of these birds, which covers an extent of thirty or forty acres, at the north end of Macquarrie Island, in the South Pacific Ocean. The number of Penguins collected together in this spot is immense, but it would be almost impossible to guess at it with any near approach to truth, as, during the whole of the day and night, 30,000 or 40,000 of them are continually landing, and an equal number going to sea. They are arranged, when on shore, in as compact a manner and in as regular ranks as a regiment of soldiers; and are classed with the greatest order, the young birds being in one situation, the moulting birds in another, the sitting hens in a third, the clean birds in a fourth, &c.; and so strictly do birds in similar condition congregate, that should a bird that is moulting intrude itself among those which are clean, it is immediately ejected from among them.

The females hatch the eggs by keeping them close between their thighs; and, if approached during the time of incubation, move away, carrying the eggs with them. At this time the male bird goes to sea, and collects food for the female, which becomes very fat. After the young is hatched, both parents go to sea, and bring home food for it; it soon becomes so fat as scarcely to be able to walk, the old birds getting very thin. They sit quite upright in their roosting-places, and walk in the erect position until they arrive at the beach, when they throw themselves on their breasts, in order to encounter the very heavy sea met with at their landing-place.

Although the appearance of Penguins generally indicates the neighbourhood of land, Mr. G. Bennett, cited several instances of their occurrence at a considerable distance from any known land.

REEVES'S PHEASANT.

The Secretary announced the recent addition to the Menagery of the *Perdix sphenura*, Gray; the *Philippine Quail*, *Coturnix Sinensis*, Cuv.; and the *Hemipodius Dussumieri*, Temm.?: all presented to the Society by John Russel Reeves, Esq., of Canton. He added, that a second male specimen of the Reeves's Pheasant, *Phasianus veneratus*, Temm., has been sent to the Menagery by John Reeves, Esq. A pair of the middle tail-feathers of the last-named bird, measuring upwards

of five feet in length, and presented by William Craggs, Esq., were exhibited.

JACKETED MONKEY.—TORTOISES.

May 27.—A letter was read, addressed to the Secretary by Sir R. Ker Porter, Corr. Memb. Z. S., dated City of Caracas, April, 7, 1834. It related chiefly to a Monkey, and to some Tortoises, recently presented to the Society by the writer.

The Monkey is described in detail. It is the *Pithecia sagulata*, the jacketed Monkey, or *Simia sagulata* of Dr. Traill. Sir R. Ker Porter points out the several differences in colouring which exist between this individual and the published description by the Baron Humboldt of the *Pithecia Chiropotes:* these consist chiefly in the comparative paleness of its back, and the greater darkness of the remainder of its body, and of its bushy beard. He adds that the animal drinks frequently, always bending down on its hands, and putting its mouth to the surface of the water, heedless apparently of wetting its beard, and indifferent to the observations of lookers-on: he never saw it take up water in the hollow of its hand, and carry it in this manner to its mouth in order to drink. Its favourite fruit is the apple; and it does not refuse the pinion of a roasted chicken. Its voice is a weak and chirping whistle, which becomes shrill and loud when the animal is angry. It was obtained from the vicinity of the Orinoco, not far distant from the Rio Negro, in the heart of Guiana. It is known as the *Mono Capuchina*.

The Tortoises are referable to the *Testudo carbonaria*, Spix.

ONE-HORNED RHINOCEROS.

May 27.—The Secretary stated that there had been acquired for the Menagery a Rhinoceros of the one-horned species of Continental India. It is said to be about four years old. Its height at the loins, the highest part of the back, is 4 feet 10½ inches; its length, from the root of the tail to the tip of the nose, measured in a straight line, is 10 feet 6 inches; its weight is about 26 cwt.

SANDWICH ISLAND GOOSE.

May 27.—A specimen was exhibited of the young of the Sandwich Island Goose, *Bernicla Sandvicensis*, Vig., which was hatched at Knowsley. It was accompanied by the following note from the President, Lord Stanley.

"Through the kindness of John Reeves, Esq., I received at Knowsley, a pair of these birds on the 15th of February, 1834. They did not at first, when turned out on the pond among the other water-fowl, appear to take much notice of each other; but some workmen being at the time employed about the pond, one of the birds (I think, from recollection, it was the male,) seemed to have formed some sort of attachment to one of the men working. Whenever he was present, the goose was always near to him, and whenever absent at his dinner, or when otherwise employed, the bird appeared restless, and gave vent to its solicitude by frequent cries, which, as well as the anxiety, always ceased with the reappearance of the workman.

"The man having frequently occasion to pass through a door, which was obliged to be kept open, it was feared that the attachment of the animal might lead to its following its friend, and that on its exit, it might fall in with and be worried or stolen by vermin, and in consequence the

pair of geese were confined in one of the divisions adjacent to, but divided from, the pond, on February 26.

"Within this small inclosure, in the sheltered half of it, in one corner, stood a small hutch, in which the female on the 5th of March laid her first egg. Till within a few days of that period, no alteration took place in their manners, but it then became obvious that the male was jealous of intruders, and would run at and seize them by the trousers, giving pretty sharp blows with his wings; but this always ceased if he observed that the female was at some distance, when he would instantly rejoin her: his return to the female was always accompanied by great hurry and clamour, and much gesticulation up and down of his head, but not of the wings. Three other eggs followed on the 7th, 9th, and 11th of March. The eggs were white, and very large in proportion to the size of the bird, being, I should imagine, (for, having no proper scales at hand, I did not weigh or substract any of them, hoping that more might be laid,) fully equal to those of the Swan Goose, or *Anas cygnöides*. The goose also surprised us by the rapidity of her operations, for we were hardly aware of the fourth egg having been laid that morning, when it was evident that she had begun to sit. During the whole period of incubation there could not be a more attentive nurse, and indeed she could not well help it, for the male, if she seemed inclined to stay out longer than he thought right, appeared, by his motions, to be bent on driving her back, nor was he satisfied till he had accomplished his object, when he again resumed his usual position, with his body half in half out of the hutch, and his head towards the female; but if any person crossed the yard of the division, he would immediately hurry after the intruder, though, if he found there was no intention of molesting the nursery, he seemed generally satisfied, and did not like to quit the sheltered part of the division. At night he constantly made room for himself by the female, the result of which was unfortunate towards the progeny.

"On the 12th of April, the eggs began to chip, and on the 13th, two goslings were excluded; but it was found that the mother had pushed from under her the other two eggs, which were consequently taken away and put under a hen, though, as one was very nearly cold, little hopes of any success with that were entertained, and it was in fact never hatched, but probably died in consequence of the removal by the goose at an important moment. On the morning of the 14th, it was ascertained that she or the male, who always now sat close beside her in the box, had killed one of the two she had at first hatched, for it was found dead and perfectly flat. The fourth egg, which was put under the hen, was assisted out of the shell, and appeared weakly from the first, and as its mother had lost one, we put it to her, in hopes it would do better than with its nurse. She took to it at first very well; but subsequently, both the parents beating it, it was returned to, and well cared for, apparently, by its nurse, but died on the 20th, having received some injury in one eye, either from the old ones, or perhaps from the hen scratching, and thereby hitting it. The remaining gosling is doing very well, and appears strong and lively, and the parents are extremely attentive to it; and I have little doubt but these birds may easily be established, (with a little care and attention,) and form an interesting addition to the stock of British domesticated fowls.

"In its general appearance, and its Quaker-like simplicity of plumage, it seems to approximate most to the family of the Bernacles; but it ap-

pears to have almost as little (if as much) partiality for the water as the *Cereopsis.*"

In a subsequent note, date July 22, the gosling is stated to be fully as large as the parents, and to nearly resemble them in plumage; the only differences being about the neck, which is more indistinct in front, and wants the full extension of the black down the nape, and the collar at the bottom just above the breast is only faintly marked. The legs also are as yet of a dirty greenish yellow tinge. It is not pinioned, but has hitherto shown no wish to use its wings. In fact they are the tamest of the tame, scarcely will move out of one's way if in the walks, and are constantly coming into the building, even more familiarly than the common Ducks."

ANIMALS FROM THE QUORRA AND FERNANDO PO.

June 10.—A collection of objects of zoology, made by Lieut. Allen, R.N., Corr., Memb., Z. S., during his late expedition up the Quorra into the interior of Africa, and presented by him to the Society, was exhibited. It was accompanied by another collection formed by the same gentleman at Fernando Po. They comprehended a previously undescribed species of *Plover;* an undescribed *Tetrodon* and a *Myletes;* specimens of *Polypterus Senegalus,* Cuv., and of a *Gymnarchus,* Ej.; and specimens of the three-horned Chamæleon, *Chamæleo Oweni,* Gray, and of a Galago, *Galago Senegalensis,* Geoff.; the two latter being from Fernando Po. They also included numerous Insects and *Arachnida,* both from the interior and from the island.

The bird was characterized by Mr. Gould as *Vanellus albiceps.* Between the eye and the upper mandible is situated a fleshy substance (resembling that of the common Cock) which hangs down at right angles with the beak; it is of an orange colour, and is narrow in form, being one inch and a half long and half an inch wide at the base, whence it gradually tapers throughout its whole length to the tip. The spur on the shoulders is strong and sharp, and is nearly an inch in length.

The fishes were characterized by Mr. Bennett as *Myletes Allenii* and *Tetrodon strigosus.* He remarked on the complete analogy borne by these species of the rivers of Western Africa to some of those of the Nile.

HONEY OF TREBIZOND.

June 24.—A letter was read, addressed to the Secretary by Keith E. Abbott, Esq., and dated Trebizond, Dec. 10, 1833. It gave some account of "the famous honey of Trebizond, which is spoken of by Xenophon in his history of the retreat of the ten thousand Greeks, as having produced the effect of temporary madness or rather drunkenness on the whole of the army who ate of it, without, however, causing any serious consequences. It is supposed to be from the flowers of the *Azalea Pontica* that the Bees extract this honey, that plant growing in abundance in this part of the country, and its blossom emitting the most exquisite odour. The effect which it has on those who eat it is, as I have myself witnessed, precisely that which Xenophon describes: when taken in a small quantity, it causes violent headach and vomiting, and the unhappy individual who has swallowed it resembles as much as possible a tipsy man; a larger dose will completely deprive him of all sense and power of moving for some hours afterwards." A portion of the honey accompanied the letter, and was exhibited.

BOTANY.

THE RATTLESNAKE DISARMED BY THE LEAVES OF THE WHITE ASH.

*Communicated by Judge Woodruff to Professor Silliman.**

During the summer months of 1801, I resided in the north-eastern part of the State of Ohio. Rattlesnakes were then very numerous in that region. I found the opinion universally prevalent among the inhabitants there, that the leaves of the white ash were highly offensive to the rattlesnake. Several persons of respectability assured me that the rattlesnake was never found on land where the white ash grows; that it was the uniform practice among hunters, as well as others, whose business led them to traverse the woods in the summer months, to stuff their shoes and boots, and frequently their pockets also, with white ash leaves, as a preventive of the bite of the rattlesnake; and that they had never known or heard of any person being bitten who had used this precaution.

Some time in the month of August, I went with Mr. S. Kirtland and Dr. C. Dutton, then residing at Poland, to the Mahoning, for the purpose of shooting deer, at a place where they were in the habit of coming into the river, to feed on the moss attached to the stones in the shoal-water. We took our watch station on an elevated part of the bank, fifteen or twenty yards from the edge of the water. About an hour after we had commenced our watch, instead of a deer, we discovered a large rattlesnake, which, as it appeared, had left his den, in the rocks beneath us, and was slowly advancing across a smooth, narrow sand beach towards the water. Upon hearing our voices, or for some other cause, he stopped, and lay stretched out with his head near the water. It occurred to me, that an opportunity now offered to try the virtues of the white ash leaves. Requesting the gentlemen to keep, in my absence, a watch over our subject, I went immediately in search of the leaves, and on a piece of low ground, thirty or forty rods back from the river, I now found, and, by the aid of my hunting-knife, procured a small white ash-sapling, eight or ten feet in length; and, with a view to make the experiment more satisfactorily, I cut another sapling of the

* Journal, No. 54.

sugar maple, and with these wands returned to the scene of action. In order to cut off a retreat to his den, I approached the snake in his rear. As soon as I came within seven or eight feet of him, he quickly threw his body into a coil, elevated his head eight or ten inches, and brandishing his tongue, "gave note of preparation" for combat. I first presented him the white ash, placing the leaves upon his body. He instantly dropped his head to the ground, unfolded his coil, rolled over upon his back, writhed and twisted his whole body into every form but that of a coil, and appeared to be in great anguish. Satisfied with the trial thus far made, I laid by the white ash. The rattlesnake immediately *righted*, and placed himself in the same menacing attitude as before described. I now presented him the sugar maple. He lanced in a moment, striking his head into a tuft of the leaves, "with all the malice of the under fiends," and the next moment coiled and lanced again, darting his whole length at each effort with the swiftness of an arrow. After repeating this several times, I again presented him the white ash. He instantly stretched himself out on his back, and writhed his body in the same manner as at the first application. It was then proposed to try what effect might be produced upon his temper and carriage by a little beating with the white ash. This was administered. But instead of arousing him to resentment, it served only to increase his troubles. As the beating grew more severe, the snake frequently stuck his head into the sand as far as he could thrust it, seeming desirous to bore his way into the earth, and rid himself of his unwelcome visiters.

Being now convinced that the experiment was a satisfactory one, and fairly conducted on both sides, we deemed it ungenerous to take his life after he had contributed so much to gratify our curiosity; and so we took our leave of the rattlesnake, with feelings as friendly, at least, as those with which we commenced our acquaintance with him, and left him to return at leisure to his den.

EXPERIMENTS ON THE FRUCTIFICATION OF PLANTS.

Since MM. de Mirbel, and Ad. Brongniart have been connected with the "Jardin des Plantes," at Paris, they have sedulously endeavoured to render fruitful many plants which had not before produced fruit in that or any other establishment; and their exertions have been crowned with a very large measure of success. In the instance of some passion flowers, it has been demonstrated, that although they would not impregnate with their own proper pollen, they were readily impregnated by the pollen of another species. The *Strelitzia regina*, the fruit of which was not known, has produced some, after being artificially fructified: its fruit is about the size of a walnut. Several plants of the *orchis* family have afforded fruits and seed every time after

they have been fertilized, by shedding their own proper pollen on the stigma. Nevertheless, such operations cannot be executed with the requisite precision until the most favourable times, the best state of the atmosphere, the proper degrees of light and heat, the most suitable instruments, and other questions, have been settled by a series of patient experiments. Meanwhile, the results already obtained at the "Jardin des Plantes," are in themselves very curious, and well calculated to convince those who still question that the fructification of plants is effected by the conjunction of the pollen and the stigma.*

DEVELOPEMENT OF HEAT IN THE FLOWERS OF THE CALADIUM PINNATIFIDUM.

By Dr. E. H. Schultz, of Berlin.

In the Botanical Garden at Berlin there is a very large plant of the *Caladium pinnatifidum*, which yearly, during spring, and the first half of summer, produces from twenty to thirty and more flowers. The powerful vegetation of this plant induced me, in the year 1826, to make some experiments, in order to ascertain the temperature of one of its flowers, on the supposition that here, as well as in many species of the genus Arum, an elevation of temperature would be observed. This was confirmed by an observation, which showed, that while the hot-house was at a temperature of 15° R. (61°·1 Fahr.), I saw the thermometer rise from four to five degrees, when placed in connexion with the flower. The observation made at that time, I took occasion to insert in the 2nd volume of the work, "Die Natur der lebendigen Pflanze," p. 224. To the above, I added only that which agreed with other observations, that the part of the calyx, upon which the stamina are placed, became the warmest; that also the whole of the interior of the flower became warm; and that here, likewise, the temperature again decreased as the flower decayed. M. J. N. Link, who at a later period renewed the investigation upon the same plant, could observe no elevation of temperature; and, subsequently, Professor Goppert, of Breslau, thought himself entitled to consider the said elevation of temperature as doubtful.

I had an opportunity, this year, during the flowering period, of the Caladium pinnatifidum, of observing the above phenomenon anew, and consider it of sufficient importance to be published.

The flowers of the Caladium pinnatifidum quickly decay; *i. e.* in the space of about twelve hours; so speedily, indeed, that the culminating point in the developement of the flower is between eight and ten o'clock in the evening. The flowers which open towards mid-day, on the morning of the following day appear

* Ann. d'Horticulture.

completely decayed, and again inclosed in the colourless spathe. During this period of the flower, the elevation of temperature falls, and at every other time of the day, the flowers show only the temperature of the surrounding atmosphere; so that Link, not having been attentive to this circumstance, did not find the above elevation of temperature, having measured the temperature of the flower only at mid-day. Thus far I remember, in the year 1826, I measured the temperature between six and seven o'clock in the evening, without, however, being particularly attentive to the period of the flower.

On the first of May this year, at mid-day, I had one of the flowers, which was beginning to burst, cut off from the plant, and found before and immediately after the separation, that the temperature of the flower was completely the same with the temperature of the air in the hot-house. I took the flower home with me, and placed it with the cut end of the stalk in a glass of water, in order to observe the phenomena during the period of its blooming. The temperature of the room was 13° R. (61°·2 Fahr.), and the flower had likewise the same temperature until about five o'clock in the afternoon. About six o'clock, the flower, which had been previously without any smell, gave out a very powerful odour, that reminded me of trying the temperature. This had risen 2°; for that of the flower was 15° R. (65°·1 Fahr.) At seven o'clock, the temperature had risen to 17° (70°·2 Fahr.) At eight o'clock, to 19° (74°·7 Fahr.); half-past eight, 19½° (76° Fahr.) At nine o'clock, 20½° (78° Fahr.) At ten o'clock, 21½° (81° Fahr.); and this appeared to be the greatest height, since there seemed to be no farther increase up to eleven o'clock. During this elevation of temperature, the disengagement of the odour likewise increased; this became so powerful, that the whole room was impregnated with an ammoniacal vapour. In the morning, the temperature of the flower had again fallen to the temperature of the air. During the following evening, no further elevation of temperature was manifested in this same flower. But, on the contrary, with other flowers which bloomed at a later period upon the same plant, there was the same gradual elevation of temperature and disengagement of odour, which afterwards, during the evening and night, impregnated almost the whole of the air in the hot-house.

When this observation is compared with that of Lamarck and Senebier upon the Arum Italicum, and of Huber upon the Arum cordifolium, there appears a most striking difference in the period of the disengagement of the caloric; likewise in the quantity of caloric, which in the case of the Arum cordifolium rose from 19° to 44°, therefore 25°. Senebier found, in Geneva, the highest temperature in the Arum Italicum to be developed at a quarter before seven in the evening. On the contrary, according to Bory de St. Vincent, the greatest elevation of temperature of the Arum cordifolium in Madagascar, shows itself in

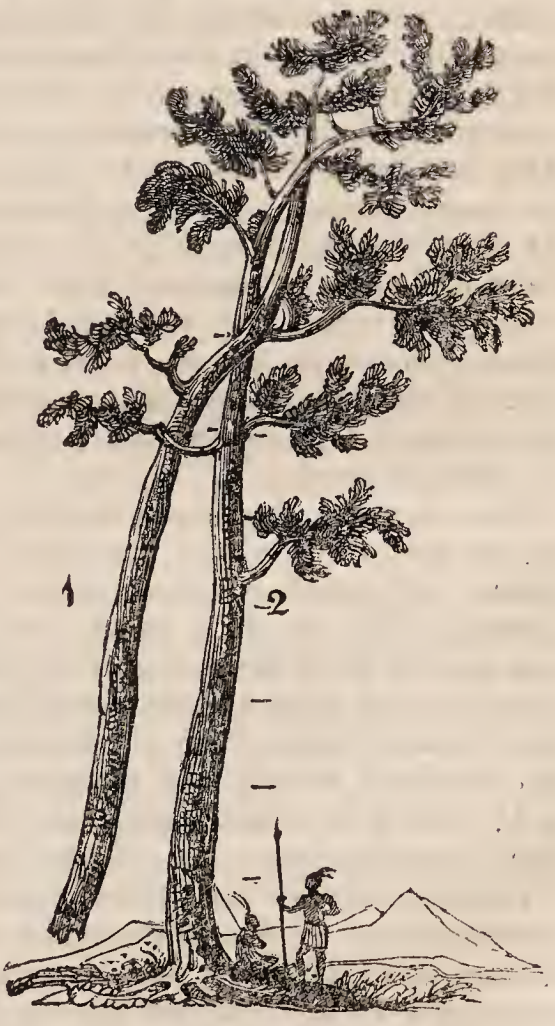
the morning, after sun-rise, about seven o'clock; and from eight o'clock the temperature gradually declines until the flower decays; so that, in the evening, the temperature of the flower differs but little from that of the atmosphere.

The Caladium pinnatifidum, which in Berlin shows the highest temperature of its flower about ten o'clock in the evening, grows wild in the shady forests of Caraccas. Hence it is possible that the periods of its disengagement of caloric, as well as the periods of its blooming, generally regulate themselves according to the peculiarity of the vegetation of the plant, as well as according to the climate of its native country.*

A PARASITE TREE.

Lieutenant Long, of the United States' Artillery, has communicated to *Silliman's Journal*, No. 53, the following details of this phenomenon, in Mr. Gee's plantation, three miles south of Quincy, Gadsden county, Tallahasse, Florida.

It is a yellow pine tree bearing another in a perfectly healthful and flourishing state, like itself, and those in the woods around them. The trees, as represented in this sketch, are united about thirty-five feet from the ground, where they entwine around each other. The one that is borne (marked 1), extends down to within about two feet of the ground, and is alive and healthful to its lowest extremity.



(Parasite Tree.)

These trees have been, in the condition in which they now are, for a period longer back than the first settlement of the country by the present population. They were pointed out by the Indians as a curiosity to the first Americans who came to Florida. The stump of the tree which is borne, has long since disappeared, and the place which it occupied is now grown up in small bushes and grass.

* Jameson's Journal, No. 31.

M. BIOT ON THE SAP OF PLANTS.

In all my experiments, the motion of the sap appears to me to proceed from the eminently hygroscopic quality of the vegetable tissue. The sap received at the roots evaporates by the leaves, whilst between these points the vegetable tissue acts precisely as a cylinder, composed of animal charcoal, covered with an impenetrable envelope, and with its lower part immersed in liquid. The column is thus supplied with all the liquid that it can contain; the vegetable tissue becomes itself in the state of saturation that suits its mass under the existing temperature. This kind of equilibrium being established, should any cause, a sudden change of temperature for instance, increase the evaporation at the extremity of the branches, these will act by suction; draw more from the roots, and the equilibrium is still preserved. Should, however, the roots come to furnish more, and the leaves evaporate less, then will ensue turgescence in the vegetable tissue; and if a hole be made, the sap or liquid will overflow. This is precisely what is observed in the birch tree in spring, when its sap begins to rise, and before its leaves have come forth, or are able to perform their task of evaporation.

As another trait of resemblance, it may be remarked, that the lateral action of heat on any hygroscopic column, such as we have represented the vegetable tissue to be, would have the effect of rendering it capable of less saturation, and, consequently, would oblige it to throw out a part of the liquid it contains. This is the effect which the sun produces upon the birch, and upon other trees, whose sap runs out at this period. When the leaves come these phenomena cease; the task of evaporation is performed, and the sap bursts neither from the bark, nor through an orifice, if made.

Now suppose we replace the impermeable or air-tight envelope by one, on the contrary, capable of absorption from within, and exhalation from without, the state of things will be changed. The issue of the sap or liquid, by the sides of the envelope, will be more frequent and facile. The diminution of the exhaling power by a sudden cold will favour it, and the sap will burst forth at once from all the pores of the tree equally, taking into account merely the different degrees of thickness in the bark. Such is an account of the emission of sap by the sides of the nut tree and sycamore, in spring.

The influence of the leaves on the internal motions of the sap in trees being thus explained, let us observe what will be the consequence, if these leaves, or great evaporating organs, be enveloped with a colder atmosphere. The sap conveyed to them being no longer evaporated, will rest and collect on their surface, and check all evaporation, especially at night. The upper parts of the vegetable tissue, or hygroscopic column, being thus overcharged, will let fall their superabundance upon the

parts that are lowest, which will produce a descent of the sap. Hence proceed the alternate ascent and descent of sap, such as have been noticed. Moreover, these effects will become continuous, if the evaporating property of the leaves should diminish before the supplying power of the root ceases to throw up the sap; and this is precisely the case in September: the same trees that afforded me but their ascending sap in the spring, in September afforded a continual sweat. The latter was no longer the same as the spring sap, for it contained no saccharine principle.

M. Biot concludes from his experiments, that the alimentation of the foliaceous organs is accomplished principally during the day; whilst the alimentation of roots, and the formation of new layers of them, is effected during the night, when the diminution of evaporating power in the leaves precipitates the sap in a descending course towards the roots.

That in deciduous trees, the annual increase of the trunk and branches taking place in summer, the increase of the roots takes place in winter. The ascending motion is thus suspended by the cold, and the absence of leaves allows the sap to accumulate in the roots, which experience little of the atmospheric variations, and which, in the first warmth of spring, send up their accumulated juices with force through the uppermost parts of the tree.*

PRESERVATION OF VEGETABLE SUBSTANCES IN A SOLUTION OF COMMON SALT.

In the Transactions of the Linnæan Society, vol. xvi., p. 761, is the following extract from a letter addressed to the Secretary, by William Cooke, Esq., on the preservation of vegetable substances in a solution of common salt:—"On the 30th of October, 1826, Mr. B. M. Forster brought to me a specimen of *Clavaria muscoides* of Sowerby, with a desire that I would preserve it in the same that I preserve anotomical preparations, (*Vide* Med. and Phys. Journ., March, 1816.) I put it into brine a little below saturation, suspending it by a delicate thread of silk, and closing the bottle by means of glass. Since that time it has remained in the solution, and with the exception of having become a little deeper in colour, it is unchanged. As spirits are not only expensive, but usually deprive plants of all colour, the discovery of a cheap and effectual solution for the preservation of plants is a desideratum."†

GROWTH OF PLANTS.

M. Meyer, superintendant of the botanical garden at Koenigsberg, in Prussia, has endeavoured to ascertain at what hours of

* Field Naturalist—February. † Repertory, No. 3.

the day plants have the most considerable growth. To this end he made choice of a certain number of the roots of the belladona (*Amaryllis Belladona*), a plant well known to be of the most rapid growth; and he measured the stalks regularly three times a day—namely, at six in the morning, at noon, and at six in the evening, taking note also of the temperature by means of a thermometer. All the results obtained have been exhibited in tables, which show at the first view, that the plants grow twice as much during the day as in the night; and this circumstance is attributed by M. Meyer to the combined influence of warmth and light. This observer also remarked, that the growth of the plants was in proportion to the elevation of the temperature; but it was found to be impossible to ascertain the degree of influence which the light exercised upon the growth, because the total privation of light, by lowering the temperature and injuring the health of the plant, precluded any result in which much confidence could be placed.*

INFLUENCE OF CLIMATE ON PERIODS OF VEGETATION.

The following are the periods at which the leafing of the specified trees usually takes place in the different parts of Europe mentioned.

Leafing.	Upsal.	Naples.	Paris.	Selborne.	Catsfield.	Stratton.	England.
Elder	Mar.1—8.	Jan. 14.	Feb. 14.	Mar. 16.	Mar. 8.		Mar. 12.
Elm	Mar.15.	Feb. 6.	Mar.	Apr. 3.	Apr. 25.	Apr. 6.	Apr. 15.
Birch	May 1—8.	Mar. 21.	Apr.	- -	- -	Mar.29.	Mar. 29.
Beech	May 1—8.	Mar.21.	- -	Apr. 23.	May 9.	Apr.23.	May 1.
Lime	May 1—8.	Mar.21.	- -	- -	- -	Apr.13.	Apr. 13.
Oak	May 1—8.	Mar.31.	May	- -	- -	Apr.26.	Apr. 26.
Chestnut	- -	- -	Mar.	- -	- -	Apr.21.	Apr. 21.
Mulberry	- -	- -	May.	June 4.	May 31.	- -	June 2.

The last column gives the mean of the three preceding columns, and may therefore be taken with considerable accuracy for the regular date of the appearance of the leaves of those trees in the southern and eastern divisions of England, and, indeed, in England in general, excepting perhaps its most northern parts. The Naples column exhibits the true mean of the dates of different years. From this table it appears that at Upsal, the elder unfolds its leaves about one week, the elm one month, sooner; but the beech from three days to a week, the oak seven or ten days, the lime two or three weeks, and the birch nearly five weeks, sooner than the same do in England. That at Naples, the elm is earlier by about nine weeks, the elder eight weeks, the beech six weeks, the lime three weeks, the oak nearly four weeks, and the birch only one week, than with us. And that at Paris, the elder, the elm, the chestnut, and the mulberry, are from two to four weeks sooner, but the birch and the

* Printing Machine, No. 21.

oak are some days later, than in England. In general, it may be asserted that, in the environs of Naples, the expansion of the leaf is earlier by one month and a half than that of the same plants in the north of Europe.*

EFFECTS OF MOUNTAIN HEIGHTS ON PLANTS.

M. Gay, in his recent interesting tour among the Cordilleras, discovered many beautiful and rare species of *Baccharis, Loasea, Alstrœmeria,* and, "above all," he says, "those charming *Mutisia* which exhibit this singular phenomenon." The tendrils with which these plants are usually furnished, becoming useless in these cold regions, unprovided with shrubs or bushes, change into real leaves, organs of such great utility to alpine plants. I have also remarked that the plants which are herbaceous in the plains, become here entirely ligneous; and that several trees, especially the *Escallonia,* instead of assuming that forked appearance which characterizes it, becomes stunted, creeping along the rocks, and thus offering less surface to the cold, with which the wind is charged in passing over these numerous and immense glaciers. But another observation which I have also made among these cold regions, is still more interesting: it is the form of imbricated leaves, which the greater portion of the vegetables assume—those genera even whose habitual form seems to be entirely contrary to this disposition. Thus, the leaves of the *Triptilions,* which are so lax and small in the lower regions, become here extremely hard and tough, closely imbricating the stalk, and even the flowers of these beautiful plants; the *Mutisia,* which is nearly devoid of leaves, when at the side of the mountains, produces at their summit a considerable number. The Violets here have not that elegant form which we observe in those lower down, but are found under a form altogether different; they represent a rosette, which may be compared to that of a *Sedum,* with this difference, that the leaves, instead of being almost vertical, are in these alpine violets entirely horizontal. These leaves, which are extremely hard and tough, are round, scabrous, strongly imbricated, and exhibit at the footstalks flowers, which are sessile, and of a violet colour, somewhat approaching to red. Although very familiar with the genera *Triptilion, Escallonia, Mutisia, Violi,* the particular aspect of these alpine species caused me to mistake them entirely, and I did not discover to what genus they belonged, until I studied them after my return."†

* Philosophical Magazine. † Field Naturalist, February.

GEOLOGY.

EARTHQUAKE IN SOUTH AMERICA.

An official account of the late dreadful earthquake in America was received on the 7th of June, 1834. By this it appears that not only was the city of Pasto, with a population of 15,000 souls, destroyed, but that that of Popayan, with double the population, suffered the same fate. In Pasto, all the religious houses, the churches of Jesus de Roi and San Andrew excepted, which escaped with the loss of their steeples, were destroyed. The cathedral and the churches of San Francisco, San Sebastian, Santiago, with their convents, and Santa Domingo, Mared, and Monjas had been completely dashed to pieces. Only three or four houses escaped, and those with much damage; and in most of the buildings not a vestige even of the foundation remained. The country around presented one scene of desolation, and the houseless and wretched people were exposed by day to the scorching sun, and by night to the chilling frosts peculiar to the climate. It appears the earthquake commenced at seven o'clock on the morning of the 20th of January, and that for four hours the motion of the earth continued. A repetition of the shocks occurred on the 22nd, and completed the ruin. All the villages in the neighbourhood of Pasto, Laguna, Mocondino, Buesquillo, Pejimdino, Puerres, Cunehalla, Tamondino, Tongovito, Gualmatan, Pandraco, and Tescuel, had been much injured, and the churches all destroyed. In the districts of Malatuy, Vacuanquir, Tambo, Bucaco, Funds, and the neighbouring parishes, great injury had been sustained. The commissioners appointed by the government had reported that on the right of the large lake in the district of Sibundoy, a small rising ground had been observed that vomited forth from its bosom large pieces of rock, and that huge and perforated caverns had appeared in the neighbourhood; that of the surrounding desert of Bondoniella half had been swallowed up, and the other part so raised above the surface that it had formed a mountain of great height, like that lofty height between Sibundoy and Ajuadrico, which, in its formation, overspread a great deal of the original soil. The commissioners further state that this mountain has, from further convulsions of the earth, mouldered away, and covered the high roads, causing the formation of immense marshes in the neighbourhood; that portions of the earth had precipitated themselves into the bed of the river Baldayaco, and obstructed its course, the sudden and impetuous overthrow of which had destroyed the lands and houses of the people of Santiago, forming its waters even as far as Putumac, having been in its course increased by tributary streams to the number of 90. The inhabitants had fled in great terror to the highest mountains. Almost the whole of the canton was overspread with large abysses, and the extreme of wretchedness prevailed throughout the country.

ARTESIAN WELLS.

On Feb. 3, at the Paris Academy of Sciences, M. Hericart de Thury read a notice on the results obtained at Tours, by M. de Gouzée, civil

engineer in that town. The well sunk under the direction of this skilful engineer gives 1,502,000 litres of water in twenty-four hours. The ascension of the water is twenty-nine metres above the level of the Loire, and four or five metres above that of the soil. Three years ago the town of Tours was supplied by fountains which were often dry in summer; at present, four bored wells give such a volume of water, that each inhabitant has 149 litres per day.

The quantity of water furnished by these wells has been rapidly increasing—the first having given 30,000 litres of water in twenty-four hours; the second 75,000; the third 173,000; and the fourth 1,500,000.

The power of ascension of the water in the last well is very considerable. It cast up, the first days, fragments of a green free-stone of a cubic inch. A ball of four pounds, introduced into it, was ejected with force. It was the same with balls of six and eight pounds. A tin cylinder, containing twenty-two balls of eight pounds, was thrown up.*

MOTIONS OF SHINGLE BEACHES.

On the 10th of April, a paper was read before the Royal Society, entitled, "Observations on the Motions of Shingle Beaches," by Henry R. Palmer, Esq., F.R.S.; of which the following is the official report:—

The author states that the object of his inquiries is limited to the collection of such facts as may assist in establishing practical rules for controlling the motions of the beach, with a view, on the one hand, to the preservation of clear channels where such are wanted, and on the other, to the obtaining accumulations of shingles in situations where they may be useful. He considers the actions of the sea on the loose pebbles as of three kinds; the first, which he terms the accumulative action, heaps up or accumulates the pebbles against the shore; the second, or the destructive action, disturbs and breaks down the accumulations previously made; and the third, or progressive action, carries the pebbles forwards in a horizontal direction. The causes of these actions are referable to two kinds of forces; the one being that of the current, or the motion of the general body of the water in the ebbing and flowing of the tides; and the other that of the waves, or that undulating motion given to the water by the action of the winds upon it.

He adduces many facts which show that it is not, as is generally believed, the currents which move the pebbles along the coast, the real agent being the force of the waves, the direction of which is determined principally by that of the prevailing winds, which, on the coasts of Kent and Sussex, where the author's observations were chiefly made, is from the westward. Every breaker drives before it the loose materials which it meets, throwing them up on the inclined plane on which they rest, and in a direction corresponding generally with that of the breaker. In all cases, the finer particles descend the whole distance with the returning breaker, unless accidentally deposited in some interstice; but the larger pebbles return only a part of the distance, this distance having an inverse ratio to its magnitude. This process constitutes the accumulative action. Under other circumstances, on the contrary, depending on the quickness of succession of the breakers, pebbles of every dimension return the whole distance along which they had been carried up, and are also accompanied in their recession by other pebbles which had been previously deposited;

* Athenæum, No. 330.

and this constitutes the destructive action. This latter action is also promoted by a form of coast, such as that produced by rocks, tending to confine the returning waves in particular channels, whereby, being collected into streams instead of being broken and dispersed, they acquire, on the recoil, sufficient force to carry down the pebbles, and deposit them below the general surface. The author gives examples of these effects, from what he has observed in the neighbourhood of the harbours of Folkstone, Dover, and Sandgate, and along the coast as far as the bay called Sandwich Flats; accompanied by illustrative drawings.

On these principles, the author thinks it will readily appear why the various attempts hitherto made to divert the motion of the shingles to a distance from the general line of the shore, both at Dover and at Folkstone, have invariably failed; and he recommends, for the prevention of the evil of accumulation, the adoption of a more general system of management along the coast, in preference to the resorting to particular devices adapted exclusively to each particular case.*

MINERALOGICAL AND GEOLOGICAL DISCOVERIES IN AMERICA.

We extract the following from a paper in *Nile's Register* (U. S.), the purport of which is to show that the prosperity of individuals and of nations is in proportion to the industry, the skill, and the general intelligence which is applied in unfolding and appropriating those gifts of nature which a wise and bountiful Creator has scattered around in rich profusion and variety.

"A geological excursion of Professor Silliman, with several of his pupils, a few years since, in the vicinity of New Haven, led to the discovery, that the stone walls, which had been standing a hundred and fifty years, as the inclosures of farms, were principally composed of the verd antique marble, commonly considered the most beautiful marble known upon our globe. At this place commences a range of this useful material for architecture, and for various works of ornament and taste, which continues for many miles, and in exhaustless abundance. From Hallowell Maine, granite of the most valuable and beautiful kind is carried to nearly all our seaports, from New Orleans to East Port, where it is used in great quantities, for the building of houses, wharfs, and various other purposes. But a few years ago, stone of an inferior quality was brought from a distance for buildings within a few rods of these inexhaustible quarries, which now disperse their riches to other cities and other states. Copperas, which is used in vast quantities in this country, especially for the purpose of dyeing, was, until recently, procured entirely from foreign countries. The researches of geologists have discovered that copperas ore, the sulphuret of iron, exists in many parts of our country in sufficient quantities to furnish the world with this necessary material in the arts, at a far less price than it is supplied from abroad. In Strafford, Vt., copperas is made, in a great measure, by a spontaneous process, from the ore in that place, in sufficient quantities to supply all demands, and at such a price as to put an entire stop to importations of that article. Formerly chrome yellow sold at sixteen dollars a pound: the chromate of iron, found in great abundance in the vicinity of Baltimore, together with the increased skill of changing it into the chromate

* Repertory, No. 6.

of lead, or chrome yellow, has reduced this beautiful and useful paint to fifty cents a pound. Epsom salts, but a few years since, were furnished to this country entirely by importations from abroad: they are now made in Baltimore, from magnesite, a mineral found in great abundance in the vicinity of that city, of a better quality, and at a cheaper rate, than they were, or can be, from foreign countries. The mines of Mexico and South America, until recently, furnished our mint and the arts with the principal part of their gold. The researches of Professor Olmsted, of Yale College, and those of other geologists in different parts of the country, have discovered that gold-mines are extensive and abundant in Georgia, the Carolinas, Virginia, and some other states."*

OUTLINE OF THE GEOLOGICAL HISTORY OF COMMON SALT.

By Mr. Brayley, Jun.

From the circumstance that in England deposits of mineral chloride of sodium, or rock salt, are confined to the formation called by geologists the new red sandstone, it was inferred that this formation was the peculiar repository of mineral salt in the earth's crust; and even the known occurrence of mineral salt in distant countries was held to be sufficient evidence of the existence of the new red sandstone in them, when nothing further was known of their geology. But within these few years it has been found, that either deposits of rock-salt, or brine-springs (which must derive their origin from beds of that substance acted upon by water), occur among rocks of almost all ages. This is what we might expect, indeed, from the collective tenour of all the facts of geology; for as the remains of marine animals are found in strata of every geological epoch,—from the period of the transition rocks, at which organized beings appear first to have come into existence, down to those of the most recently formed deposits,—it is clear that the sea must have existed throughout the entire period from the formation of the transition rocks to the present time. And if the sea existed, it must necessarily have happened that its saline contents would be deposited in a solid form, more or less, during the production of every class of rocks. Accordingly, in certain parts of the United States, salt, or brine-springs, are stated by Mr. Featherstonhaugh to issue from old *transition* slate-rocks. In the English coal-measures are several copious salt-springs. The rock-salt of Cheshire, and the salt-springs (which are known to issue from beds of the same substance) of Worcestershire, are situated in the new red sandstone belonging to the *secondary* rocks. In Wurtemberg, Alberti has proved rock-salt to exist in the upper members of the same series, called the *Keuper* and the *Muschelkalk*. In Switzerland, Mr. Bakewell places it in the lias, a formation which succeeds the new red sandstone, in the ascending order. In the Austrian Alps, Messrs. Sedgwick and Murchison have shown it to occur in the upper oolites, still higher or more recent, in the order of geological formations. The salt deposit of Wieliczka, near Cracow, constitutes a portion of the strata more recent than the chalk, and belonging, therefore, to the *tertiary* series. And, —to bring down the deposition of common salt in the earth to the present time,—in the Crimea it is said to be daily accumulating in inland lakes. These facts constitute an outline of the geological history of

* Quoted in the Athenæum, No 363.

common salt, the substance in which the largest proportion of the base of the alkali soda occurs in nature, and from which, therefore, the largest proportion of the alkali itself is obtainable.*

BURNING MOUNTAIN OF AUSTRALIA.

Communicated by the Rev. C. Pleydell N. Wilton, M.A., to the New South Wales Magazine, No. 1.

My first excursion to Mount Wingen I accomplished in the early part of the year 1829; my second visit was in 1832. I had again an opportunity of observing the progress of ignition on this mountain in the middle of 1833. The fire was at the period raging in two directions—viz. S.S.W., and on that portion of the summit where it had been long extinct to the eastward, having made rapid progress in the former direction since my previous visit. I had the good fortune, on this occasion, to procure some excellent specimens of crystals of sulphur, sulphate of alumine, muriate of ammonia, &c., which I secured on the spot with wax, in compartments made in trays, so formed as to fit tight into a large box. On my fourth visit to the same spot, I found the sulphureous vapours ascending in much thicker columns, and the red heat in the crevices more intense and continuous, than on any former occasion. A greater portion also of the mountain was under ignition, and the fire was raging up the acclivity to the S.S.W., and over a space below on a portion of the mountain to the N.W., which had not been submitted to its action evidently for a long period. The thermometer, placed at the margin of one of the crevices, where the sandstone below was at a red heat, rose to 170°. An amazing quantity of muriate of ammonia, and of sulphate of alumine, as well amorphous as stalactitic, and in the shape of porous balls, is being constantly formed. The stock of the latter had been lately much reduced, this substance being greatly in request amongst the neighbouring settlers, as a cure for the disease in sheep. Before I quitted the mountain, and while engaged in searching for varieties of agate, fragments of which are very abundant, a most beautiful specimen of quartz crystals upon this mineral, of about a foot in diameter, was dug out of the earth at no great distance from the scene of fire and disruption.

THE VAPOUR CAVE AT PYRMONT, SIMILAR TO THE GROTTO DEL CANE, AT NAPLES.

This cave is situated at a distance of about 800 feet from the well known mineral spring of the same name. It is not a natural formation, but was hollowed out, and fitted up, in the year 1740, by Dr. Seip, whose attention was drawn to the place by the quantity of suffocating vapour exhaled from the fissures of the rock. Similar streams of gas issue from many places in the immediate neighbourhood of the cave, and of the mineral waters themselves, giving them a sparkling and effervescing quality. The geological characters of the ground are, that it belongs to the variegated sand-stone formation, and that it consists of marle and ferruginous sandstone. The stream of gas is constant, but the quantity issuing varies much at different times; so that the height of the gaseous layer, above

* Parkes's Chemical Catechism, by Brayley.

the surface, may be from one to eight, or even twelve feet. It is generally highest soon after sunrise and sunset in clear, warm weather, or at the approach of a storm; also during a hoar frost in winter, during which the vapour atmosphere has stood so high over the mouth of the mineral springs, that children, and even adults, have fallen down asphyxiated, while attempting to draw the water. The gas is sour to the taste, and has a suffocative smell; the relative quantities of the carbonic acid, and of common air, vary according to the level from the ground at which we collect the gas; at the bottom it consists of 48 carbonic acid and 52 air; at three feet the proportion of the former was only 36½; there is no admixture of any sulphurous gas. With regard to the effects which it produces on animal life, we may state, generally, that it is a very exciting, momentarily-irritating, heating, and antiseptic agent; a pleasant, tingling warmth, is experienced in the limbs; if the person stoops down, he is soon sensible of the sourish taste, and of a pricking in his eyes and nose; he becomes oppressed and dizzy, his breathing is laborious, and the pulse is much quickened; these symptoms become gradually more and more aggravated, until complete asphyxia be induced. The poisonous force of the Pyrmont cave is, however, much inferior to that of the Grotto del Cane, or the "Poison Valley" of Java, although the agent of destruction be the same in all, varying only in the relative proportion of its quantity. When the carbonic acid gas is nearly pure, or much exceeds the volume of atmospheric air, with which it is combined, it produces, if attempted to be inspired, a spasm of the rima glottidis, and thus the entrance of the air is quite stopped up, and speedy death necessarily ensues. Such phenomena have been observed in the Grotto del Cane, and the Poison Valley: the vapour of the Pyrmont cave being more diluted, is only slowly fatal to animals of moderate bulk. Thus, a rabbit remained in it two minutes, and a cat four, yet recovered on being withdrawn. The latter was killed by exposure of fifteen minutes. A dog, two years old, bore immersion for thirty minutes, when he became asphyxiated, but after some trouble was revived. And a large shepherd's dog, six years old, showed signs of life after immersion for an hour and seven minutes, nor did they totally cease until nearly three hours had elapsed from the beginning of the experiment. The death, induced by breathing carbonic acid, seems not to be a painful one; a stupefaction speedily follows a short-lived excitement. Those who have willingly exposed themselves for a few minutes to its influence, state that they might have died in the most tranquil manner, had they not been soon removed from the narcotic atmosphere.—*Graefe and Walther's Journal.**

NEW CLASSIFICATION OF FISHES—FOSSIL ICHTHYOLOGY.

On Nov. 5, a paper was read, before the Geological Society, "On a new Classification of Fishes, and on the Geological Distribution of Fossil Fishes." By Professor Agassiz, of Neuchatel.

The author begins by stating that the state of the science of Ichthyology had obliged him to undertake an examination of recent fish for the sake of comparing them with the fossil species, and in doing so he had arrived at a classification of fish in general, differing considerably from the

* Quoted in the Athenæum, No. 341.

various arrangements previously adopted by naturalists. One of the essential characters of fish is, to have their skin covered with scales of a peculiar form and structure. This covering, which protects the animal without, is in direct relation with its internal organization; and Dr. Agassiz has found, that by an attentive examination of the scales, fish may be divided into more natural orders than had hitherto been established. In this manner he has established four orders, which bear some relation to the divisions of Artedi and Cuvier, but one of which, hitherto completely misunderstood, is almost exclusively composed of genera whose species are only found in the most ancient strata in the crust of our globe. These four orders are, the *Placoidians*, which comprehend the cartilaginous fish of Cuvier, with the exception of the sturgeon; the *Ganoidians*, which comprehend about fifty extinct genera, and to which we must refer the Plectognaths, Syngnathus, and Acipenser; thirdly, the *Ctenoidians*, which are the Acanthopterygians of Cuvier and Artedi, with the exception, however, of those which have smooth scales, and with the addition of the Pleuronectes. Lastly, the *Cycloidians*, which are principally Malacopterygians, but which comprehend, besides, all those families excluded from the Acanthopterygians of Cuvier, and from which we must take the Pleuronectes already placed in the preceding order.

If we estimate the number of fish, now known to amount to about eight thousand, we may state that more than three-fourths of this number belong to two only of the above-mentioned orders; namely, the Cycloidians and Ctenoidians, whose presence has not yet been discovered in the formations inferior to the chalk. The other fourth part of living species is referable to the orders Placoidians and Ganoidians, which are now far from numerous, but which existed during the whole period which elapsed since the earth began to be inhabited, to the time when the animals of the greensand lived. These remarkable conclusions to which M. Agassiz had come, from the study of more than six hundred fossils on the continent, have been corroborated by the inspection of more than two hundred and fifty new species found in English collections.

The author next observes, that in the class of fish more considerable differences may be remarked within narrow geological limits, than among inferior animals. We do not see in the class of Fishes the same genera, nor even the same families, pervading the whole series of formations as takes place among Zoophytes and Testacea. On the contrary, from one formation to another, this class is represented by very different genera, referable to families which soon become extinct, as if the complicated structure of a superior organization could not be long perpetuated without important modifications; or, rather, as if animal life tended to a more rapid diversification in the superior orders of the animal kingdom, during equal periods of time, than in its lower grades. With respect to this, it is with fish nearly as with mammifers and reptiles, whose species, for the most part but little extended, belong at a short distance in the vertical series to different genera, without passing insensibly from one formation to another, as is generally admitted to be the case with certain shells. One of the most interesting facts which M. Agassiz has observed, is, that he does not know a single species of fossil fish which is found successively in two formations, whilst he is acquainted with a great number which have a very considerable horizontal extent. But the class of Fish presents besides to Zoological Geology, the immense advantage of traversing all formations. Thus they afford us the only example of a great division of vertebrated animals, in which we may follow all the

surmounted by a cow's teat. I entered a bath, and plunging the apparatus and my whole body below the water, I found that I could suck and swallow, in successive efforts, as readily as in the open air. There was so little difficulty, that, on removing the cow's teat, I sucked up and swallowed all the milk during four immersions, without any violent effort.

When such is the case with man, whose power of submersion rarely exceeds half a minute, why should we doubt that cetecea, accustomed to remain submersed in their own element for a period of not less than fifteen or twenty minutes, without the necessity of respiration, are able to reiterate the action of sucking and swallowing while adhering to the mother's teat?

I may add, that to avoid any accidental chance of error, I was assisted in these experiments by my friend Dr. Cumming, of Chester.*

THE CAPYBARA.

A SPECIMEN of this rare and singular animal has lately been received at the Surrey Zoological Gardens, from South America; it having been taken on the banks of the Amazon, where it is called the river or sea hog. It is a thick-set, clumsy animal, the head and neck singularly large, and is remarkable for being devoid both of the tail and the clavicle, which striking characteristics caused Cuvier to form his genus hydrochærus. Capybaras take up their abode in the extensive forests of South America, near water, concealing themselves in burrows. They swim and dive exceedingly well, and their habits and modes of living strongly resemble those of the beaver. The present specimen is tame and domesticated.

THE FAT-TAILED SHEEP.

THE Sardinian consul at Alexandria in Egypt sent, in 1833, to Turin, a collection of curious animals, rarely met with in Africa. Among the most remarkable of these was a species of sheep, very rare, and quite unknown to the inhabitants even of Egypt. This animal was bought from an Arab, who said it was brought from a district of Arabia which he was not able to indicate with the distinctness which the consul desired. At Turin it came under the notice of M. Gené, professor of zoology in that city, who was at first inclined to think that in its internal structure and peculiar organization, it resembles the ovis steatopyga or kirgisica of Pallas; but when he came to consider it more attentively, he found it to be a species either very imperfectly described or entirely unknown. The most singular feature of the animal is its tail, which may be characterized as monstrous, whether we regard the number and dimensions of the vertebræ,

* Jameson's Journal, No. 34.

or its form and astonishing fatness. When stripped of the fat the form has much resemblance to an S. The fat itself, besides enveloping the tail, which it garnishes to the extremity, is in such abundance that it encumbers and swells up all the posterior parts in a manner to which no verbal description can do justice. Another peculiarity, which gives a most singular aspect to this animal, is a loose drooping skin, not unlike the dewlap of the ox, which extends itself from the angle of the lower jaw to the middle of the neck. The head is of an intense and brilliant black colour, but the rest of the body and the limbs are white, except that a slight tinge of yellow appears on the sinuosity of the tail. The fleece is, to the eye and touch, harsh, coarse, and stiff; but this exterior fleece covers another that is curled, elastic, and of an extraordinary fineness, which would undoubtedly render this species of sheep exceedingly useful. Unhappily, none of those which were brought to Turin were able to survive the winter.*

THE SALMON.

At the third anniversary of the British Association, Professor Agassiz delivered some very interesting observations upon the different species of the genus salmo which frequent the various rivers and lakes of Europe; of which the following is an abstract:—

The genus salmo, as it has been established by Linnæus and Artedi, or, I ought rather to say, by Rondeletius, has supplied Cuvier with the type of a peculiar family, in which he has retained the generic characters of Linnæus, viz. one dorsal fin with soft rays, and a second one, which is rudimental and only adipose. Cuvier places this family in his order malacopterygii abdominales, between the siluridæ and the clupeæ; and he subdivides it, on just grounds, into a great number of generic sections, which comprehend a vast variety of exotic species. In my work on the fishes of Brazil, I have added several new kinds to those which Cuvier established; and am of opinion that, in the natural classification, it is now absolutely necessary to unite the family of the clupeæ to that of the salmones, since the only difference we find between them consists in the presence or absence of an adipose fin; an organ assuredly too insignificant to constitute the distinctive character betwixt two families, and the less so, as there are some genera of the family which possess it, whilst in others it is completely wanting, as for example, in the siluridæ. We may with equal truth affirm, that all the real salmones of Cuvier have not this adipose fin, for in many species of the genera serrasalmus, myletes, &c. it is composed of rays which are truly osseous.

Restricted to the limits which Cuvier has assigned to it, the genus salmo comprehends all the species of which the body is somewhat lengthened, the mouth large, and supplied with teeth, which are conical, pointed, and formidable, implanted into all the bones of the mouth, that is to say, into the interior maxillary bones, both superior and inferior, into the vomer and palate bones, into the tongue itself, and into the

* Printing Machine, No. 7.

branchial arches. The margin of the upper jaw is formed by the interior and superior maxillary bones, and constitutes only a single continuous arch, as in the higher classes of animals; a conformation which, in the class of fishes, is found only in the clupeæ. It is also singular that the number of branchial rays is seldom exactly the same on the opposite sides of the head, the number varying from ten to twelve. The pectoral and the ventral fins are of a middling size; the latter placed about the middle of the belly, opposite to the dorsal; at their base, and along their insertion, there is a fleshy fringe, somewhat similar to the long scales which are found on the most part of the clupeæ. The caudal fin is attached to a very fleshy root, and is moved by very powerful muscles.

This elastic spring is to these fishes a most powerful lever; when wishing to leap to a great height, they strike the surface of the water with a kind of double stroke. By this means they overcome obstacles which appear insurmountable, and leap over nets which are intended to confine them. The most formidable waterfalls can scarcely arrest them. The several species of this genus are found in the northern and temperate regions of Europe, Asia, and America.

The fishes of this family are very ravenous, and feed principally upon the larvæ of aquatic and other insects, and of the small crustacea; they also devour fishes of a smaller size. Their alimentary canal is short, but the stomach is proportionally long and straight. At its pyloric extremity may be observed a great number of appendices, which are connected with the pancreas, and to which is generally, but erroneously, applied the name of cæcum. The swimming-bladder of the whole of them is very large, and opens into the œsophagus near the bottom of the gullet. Though I cannot here enter into the subject very fully, I may in a word state, that I am persuaded that this organ ought to be regarded as the lungs of fishes;—that the circulation of the blood in these animals has been inaccurately interpreted, when it is supposed that in their heart there may be traced a pulmonary course; also, when their branchiæ have been identified with the lungs of other animals; and, finally, when their great dorsal artery has been considered as analogous to the aorta of the mammalia.

Most of the salmon varieties reside in fresh waters; in summer they pay a visit to the sea, and do not mount up again to the rivers, unless for the purpose of there depositing their spawn. It is sufficiently remarkable that most of our species deposit their ova in November and December, and that the young fry of course comes into existence in the coldest season of the year. From this circumstance we may suppose that it is owing to this habit of enduring intense cold in the first days of their existence, that they can subsequently support all that variety of temperature to which they are soon to be exposed.

In proportion as the genus salmo is now circumscribed within its natural limits, so much the more is it difficult to characterize the various species; and I have no fear of being contradicted when I affirm, that since no one has devoted himself to their history, so no one has yet succeeded in determining, with any degree of precision, their distinctive characters. The greatest obstacle to the solution of this problem arises from our ignorance of the accuracy of the characters hitherto employed to distinguish the several species, the one from the other. We have especially attached ourselves to the form of the head, and to the arrangement of the colours; but these two particulars are much too variable to supply precise characters. As to the variation in the colour, we may say

it is infinite. There are, however, two circumstances which especially modify the tints of the salmon tribe, namely, their age, and the season of the year. The younger fish are, in general, much more spotted than the older ones, whose tints become more and more uniform. The salmo hucho, for example, with violet spots more or less distinct, has, when young, large black transverse bands upon the back, down to the middle of its sides. In the second and third years of its existence, these bands break up into black spots, less deep in colour, and they disappear more and more, till in its latter years the fish acquires a colour which is almost uniform. The salmo lacustris of Linnæus, when young, has large black and ocellated spots upon all the superior parts of its body; but from the third year they diminish, and ere long they entirely disappear. The salmo umbla, so long as it is young, is of a uniform greenish-yellow colour, with the abdomen white, and at a later period of life these tints assume a deeper hue—of a more lively green, and finally pass into a blackish-green. The abdomen soon becomes silvery-white, afterwards yellow and orange coloured, and then of a golden lustre. Its flanks are very soon adorned with ocellated yellow spots more or less distinct, but ere long there are no spots at all. In the salmo fario, the spots vary even more. In the young they are found yellow, green, brown, even black and violet, also black and red, but in the long run they all entirely disappear. I have also noticed that the seasons have an influence on the colours of the different kinds of salmo. It is during the autumn, and at the time of the greatest cold, that is to say, in October, November, December, and January, that their tints are most brilliant, and the colours become more vivid by the accumulation of a great quantity of coloured pigments. We might almost say that these fishes bedeck themselves in a nuptial garb, as birds do. The colour of their flesh varies according to the nature of their aliment. This family of fishes feed, as we have said above, especially upon the larvæ of aquatic insects, and of small crustacea. It is in the waters which contain the most of these last, that the most beautiful salmon trout are found. Direct experiments which were made in lakes, have proved, to my satisfaction, that the intensity of the colour of the flesh arose from the greater or smaller quantity of gammarinæ which they had devoured.

As to the structure of the head, it offers, in the opercular bones, in the surface of the cranium, and in its proportions relative to the whole body, very excellent characters; but those, on the other hand, which are taken from the proportional length and size of the jaw-bone, are of no value at all, since the lower jaw is longer or shorter than the upper, according as the fish opens or shuts its mouth; and this consideration introduced into the characteristics of the family, has very considerably contributed to multiply the institution of species. The hook which forms the jaw of the salmo salar is not even a peculiar characteristic of this species, since the full grown males of all the species of the genus present a crooked prolongation of their lower jaw, to a greater or less extent.

It results, then, from these observations, that the different species of the salmo family, far from being confined within the narrow limits of some small bodies of fresh water, are, on the contrary, very widely distributed. They also thrive in all climates, at least in all elevations above the surface of the ocean, whether in fresh water or in salt. It is also true, they prefer those situations where the water is limpid.

Possessed of these facts, which I had collected with the most minute and jealous precautions, I have tried to determine the various species

which are found in the fresh waters of the continent; grounding my examination upon the study of the interior organization, and upon the particulars already determined which the integuments present concerning the structure of the scales. I have also introduced the shape of the body, and the proportional size of its internal parts, as important accessaries to the description of the species. Of course I cannot enter at present into the details of a minute description. This, in fact, is the investigation of which I propose to give an account in my treatise upon the fishes of the fresh waters of central Europe. I must here confine myself to a short statement of the results I have obtained.

It is a very singular fact, that those fishes which are the most widely distributed, and those which are most highly prized, are precisely those whose natural history is the most perplexed. The opinions, too, which are so widely extended concerning their geographical distribution, are not at all in unison with the real state of things. There scarcely exists a country to the which some peculiar species of salmon has not been assigned, and I may add, that even in the regne animal of Cuvier, we find many nominal species, which are not even local varieties, as I propose ere long to demonstrate. The cupidity of the fishermen, the rivalry of epicures, and the fastidiousness of the palate of salmon eaters, have, without doubt, contributed to spread these opinions upon the narrow limit assigned to the haunts of the species of the salmon. There is especially a famous variety, in the annals of epicurism, over which the greatest possible obscurity has been cast,—it is l'ombre chevalier, the char, or alpine trout. After having attentively examined the continental varieties, I with eagerness availed myself of the opportunity I have lately enjoyed, of examining near their native haunts several species of this genus which are found in England. Through the kindness of Sir William Jardine and of Mr. Selby, I have also had an opportunity of examining all those which they have collected from the Scottish lakes; and the result has been, that I have succeeded in determining the perfect identity of many of them with the species found in other countries in Europe; while, on the other hand, I am convinced, by the observations of these naturalists, that there are species peculiar to Scotland.

I am convinced that all the fish belonging to this family, on the continent, may be reduced to the six following species:

1. Salmo umbla, Lin. the char of England,—the ombre chevalier of the Lake of Geneva,—the rötheli of Swiss Germany,—and the schwarz reutel of Saltzburg.

   Synonyms: salmo salvelinus, Lin. Salmo alpinus, Lin. Salmo salmarinus, Lin. (but not the salmo alpinus of Bloch.)

   This fish is found in England and Ireland, in Sweden and Switzerland, and in all the southern parts of Germany.

2. Salmo fario, Lin.—the trout of brooks,—common trout,—gillaroo trout,—and par.

   Synonyms: salmo sylvaticus, Schrank. Salmo alpinus, Bloch. Salmo punctatus, Cuvier. Salmo marmoratus, Cuv. Erythrinus, Lin.

   It is found as extensively as the first species.

3. Salmo trutta, Lin. Sea trout,—salmon trout. It is the same as the salmo lemanus of Cuvier; and the salmo albus of Rondeletius.

   It is found as extensively as the two preceding.

4. Salmo lacustris, Lin. The same as the salmo illanca, and the salmo schiffermulleri of Bloch.

Found in the lakes of Lower Austria, and in the Rhine above Constance.

5. Salmo salar, Lin. The true salmon. The salmo hamatus of Cuvier is the old fish, and the salmo gadeni of Bloch. the young fish.

Found in the Northern Seas, whence it ascends the rivers even as far as the Swiss lakes.

6. Salmo hucho, Lin. Of the same species as the preceding. Peculiar to the waters of the Danube.

It results, then, from these observations, that the different species of the salmon family, far from being confined within the narrow limits of some small bodies of fresh water, are, on the contrary, very widely distributed. They also thrive in all climates, at least in all elevations above the surface of the ocean, whether in fresh water or in salt. Nevertheless, they prefer those situations where the water is limpid.*

SPIDER IN LOGWOOD.

As some sawyers, at the Molyneux logwood-mill, near Prestwick, Lancashire, were engaged in rasping a small block of logwood, they came to a hole in it, from which crawled a large spider, answering very nearly to the description given of the great American spider; and as the logwood comes almost exclusively from Campeachy and the West Indies, it is probably the same. It weighed within a few grains of half an ounce, and the hole which contained it was about six inches and a half in length, and rather more than two in diameter, and in the very heart of the tree. The tree from which the block was sawn was not large, and is supposed to have been under twenty years' growth. It is conjectured that the spider proceeded from an egg which had been deposited in some small hole of the tree, while a sapling. It has been placed in the Museum of Natural History at Manchester.†

STRUCTURE OF FEATHERS.

At the British Association, Sir David Brewster communicated to the Natural History Section a verbal account, which he illustrated by figures, of some curious results which he had obtained respecting the structure of feathers. Dr. Paley and Dr. Roget had, as he mentioned, explained generally the beautiful mechanism by which nature enables the tender fabric of the vane of the feather to resist the action of the air, and to repair itself when divided. By the use of very fine microscopes of garnet and sapphire, Sir David succeeded in developing the minute structures by which the preceding mechanism operates; and he particularly described a singular spring, consisting of a number of

* Jameson's Journal, No. 34. † Printing Machine, No. 18.

slender fibres laid together, all of which resisted the division of the feather or the separation of its fibrils, and which again closed themselves together when their separation had been forcibly effected. He described the difference between down and feather, the former being intended either for ornament or warmth, and the latter for resisting the action of the air when a continued fabric was necessary. These observations were made chiefly on the large feathers from the wing of the vulture; but, generally speaking, the structure is the same in other feathers, though with various modifications. The curious property preserved by the fibrils of hooking themselves together when they had been separated, was mentioned as a singular provision of nature, though the author felt some difficulty in giving a perfectly satisfactory explanation of the manner in which it was effected.*

GUEVI.

A PAIR of these diminutive and beautiful animals, the guevi, or pigmy antelopes, has been added to the menagerie of the Surrey Zoological Gardens. They are the smallest and least known of the whole genus, and have been called the royal antelopes. The only specimen previously brought to England was one in the collection of his late Majesty at Windsor. They scarcely exceed a foot in height; are of an uniform reddish brown colour, with legs not much thicker than a goose-quill; and will bound with ease over a wall twelve feet high. They are brought from Senegal, and are exceedingly mild and gentle in disposition.†

STATISTIC VIEWS OF THE MORTALITY IN VARIOUS COUNTRIES IN EUROPE.

IN considering how limited and few the differences are which exist among the nations of Europe, either in their physical or moral order, it appears at first sight that the laws to which the duration of human life are subjected, cannot experience any very great variations even in the most distant countries. It would be erroneous, however, to believe that it is so; for in the group of European nations who live under the same zone, and whose primitive features are gradually effaced by civilization, mortality experiences as long a series of different terms as in regions inhabited by different races of men, and situated in climates the most opposite to each other.

The causes which affect the movements of the population in Europe, have even a more powerful influence on mortality than on reproduction or births. The greatest is nearly twice as great as that of the least fecundity; whilst, in many districts, the annual amount of deaths is generally three times as much as that

* Literary Gazette, No. 925. † Morning Chronicle.

to which it is limited in some others in proportion to the whole population.

In truth, the most accurate statistical returns which have been drawn up, prove that mortality is reduced in various countries to such a point, that it does not exceed one death in fifty-nine inhabitants; whereas, in many others, it increases annually to one twenty-second part of the population, and still more immensely in times of distress.

On searching in official documents for the number of deaths for several of the latter years, in the principal European states, it is found, that the difference of their mortality, compared with their population, is as follows :—

Table of the Proportion of Deaths to the Population, and of the Annual Mortality among each Million of Inhabitants in the principal States of Europe.

Countries.	Periods or Epochs.	Average number of Deaths.	Ratio of the average Population.	Annual mortality in each million of inhabitants.
Sweden and Norway,	1821 to 1825	79,900	1 in 47 inh.	21,300
Denmark,	1819	33,800	1 .. 45 ..	22,400
European Russia,	1826	960,000	1 .. 44 ..	22,700
Kingdom of Poland,	1829	93,000	1 .. 44 ..	22,700
Britannic Islands,	1818-1821	373,000	1 .. 55 ..	18,200
Netherlands,	1827-1828	163,000	1 .. 38 ..	26,500
Germany Proper,	1825-1828	290,000	1 .. 45 ..	22,400
Prussia,	1821-1826	303,500	1 .. 39 ..	25,600
Austrian Empire,	1828	675,000	1 .. 40 ..	25,000
France,	1825-1827	808,200	1 .. 39 ..	25,600
Switzerland,	1827-1828	50,000	1 .. 40 ..	25,000
Portugal,	1815-1819	92,000	1 .. 40 ..	25,000
Spain,	1801-1826	307,000	1 .. 40 ..	25,000
Italy,	1822-1828	660,000	1 .. 30 ..	33,300
Greece,	1828	33,000	1 .. 30 ..	33,300
Turkey in Europe,	1828	334,800	1 .. 30 ..	33,000
Northern Europe,	. . .	2,972,100	1 .. 44 ..	22,700
Southern ditto,	. . .	2,284,200	1 .. 36 ..	27,800
TOTAL,	. . .	5,256,300	1 .. 40 ..	25,900

According to this table, and many others of a more detailed nature, there annually dies :

1 inhabitant in 28 in the Roman State, and the ancient Venetian provinces ; 1 in 30 in Italy in general, Greece, and Turkey ; 1 in 39 in the Netherlands, France, and Prussia ; 1 in 40 in Switzerland, the Austrian Empire, Portugal, and Spain ; 1 in 44 in European Russia and Poland ; 1 in 45 in Germany, Denmark, and Sweden ; 1 in 48 in Norway ; 1 in 53 in Ireland ; 1 in 58 in England ; 1 in 59 in Scotland and Iceland.

These numbers present the following results:—

The smallest chances of life, and its shortest duration, are not, as one might believe, amongst the effects of the rigorous climate of Norway, or the marshy soil of Ireland; it is in the beautiful climate of Italy that life is reduced to its minimum extent. On the contrary, it is among the icy rocks of Iceland, and in the midst of the eternal fogs of Scotland, where man attains his greatest age.

Of all the European States, the British isles are, in this respect, the most favoured; of each million of inhabitants, they only lose 18,200; whilst the mortality is almost double in the countries washed by the Mediterranean.

Life, next to these, is most certain in Norway and Sweden. *Cæteris paribus*, three people die in the South of Europe, two only, and hardly that, die in ancient Scandinavia. Denmark and Germany enjoy, as it were, similar advantages.

Russia and Poland, where nature and fortune have not been lavish of the necessaries of life, enjoy, however, an astonishing longevity. The population, comprising a mass of nearly sixty millions, spin out their existence almost one-half longer than that which is enjoyed by the inhabitants of Italy, and exactly twice the length of time which any one can expect to live in the capital of Austria.

The average time of life which only cuts off one victim in forty annually, is to be found in the Cantons of Switzerland, the Austrian Provinces, and in the Spanish Peninsula, in consequence of the sun and the dryness of the air.

France, the Netherlands, and Prussia, nearly reach the same term, and will soon get beyond it, unless war, or some other scourge, arrests the progress of their social amelioration.

In the rest of Europe, the mortality amounts to one-thirtieth of the population, and is even frequently increased by accidental causes, which have for a long time endangered the prosperity of the shores of the Mediterranean.

On the whole, we reckon, one year with another, 5,256,000 deaths in 210 millions of people, by a mortality of one-fortieth part, which is unequally distributed among the northern and southern states. The former have only one death in forty-four, the latter, one in thirty-six persons. Of one million of inhabitants in districts situated in the north of France, 22,700 die; 27,000 die in those which lie towards the south. This is a difference of more than 5,000 deaths, equivalent to a two-hundredth part of the population.

If we carefully examine these numbers, and those of the tables of details from which they are extracted, we shall discover that two great causes which predominate over all the others, determine the ratio of mortality to the population, or, in other words, regulate the number of the chances of human life. These are the influence of climate and civilization.

The climate is peculiarly favourable to the prolongation of human life when it is cold, or even rigorous, or when the humidity in the environs of the sea is combined with a low temperature.

The smallest mortality in Europe, occurs in maritime countries which are in the vicinity of the polar circle—such as Sweden, Norway, and Iceland. This is also the case in countries where, as in Russia, the influence of climate is not aided by civilization, and of itself is sufficient to assure long life to mankind.

Countries where the heat is moderate, are not, as might be supposed, among those which possess the advantage of a small mortality; to obtain it, they must acquire the benefits of a high state of social order.

The southern countries, the mild climate of which seems to be so favourable to the human race, are, on the contrary, regions where life is exposed to the greatest dangers. In the smiling plains of Italy, the chances of dying are one-half greater than those of cold and foggy Scotland; and under the beautiful skies of Greece, the certainty of life is one-half less than among the ices of Iceland.

The places of the torrid zone, the mortality of which has been calculated, show the pernicious influence which is exercised over the existence of mankind by a high temperature.

Latitude.					
6° 10′	Batavia,	decrease of	1 in 26½	inhabitants.	Burrow.
10° 10′	Trinidad,	———	1 — 27	———	Official doc.
13° 54′	St. Lucie,	———	1 — 27	———	Pugnet.
14° 44′	Martinique,	———	1 — 28	———	M. de J.
15° 59′	Guadaloupe,	———	1 — 27	———	M. de J.
18° 56′	Bombay,	———	1 — 20	———	Transact. Acad.
23° 11′	Havannah,	———	1 — 33	———	Humboldt.

The resistance of the vital principle in the tropics differs according to the races of men; and its duration in some places is, for the one, double or triple that for the others. The following are examples of this variation:—

Batavia, in 1805—Europeans, 1 in 11 individuals; Slaves, 1 in 13; Chinese, 1 in 29; Javanese, 1 in 46. Bombay, in 1815—Europeans, 1 in 18¼; Mussulmen, 1 in 17½; Parsees, 1 in 24. Guadaloupe, 1816 to 1824—Whites, 1 in 23½; Freedmen, 1 in 35. Martinique, in 1815—Whites, 1 in 24; Freedmen, 1 in 33. Grenada, 1811—Slaves, 1 in 22; St. Lucia in 1802—Slaves, 1 in 20.

We may compare this immense mortality in the torrid zone, with that which occurs in Madeira, the only colonial establishment in the temperate zone. Heberden has calculated, that the deaths in that island were in the proportion of 1 to 49·89 of the whole inhabitants.

The effects that the degree of perfection, more or less exten-

sive, of the social economy, exerts on mortality, are not less extensive than those, the cause of which is to be found in the influence of the climate.

The influence of the progress of civilization is discovered by comparing the ratio of the deaths to the population of the same country at epochs, the intervals of which have been marked by social ameliorations. The following series of universal terms presents an instructive comparison:—

The number of deaths, compared with that of the inhabitants, was,—

In Sweden,	1754 to 1763,	1 in 34,	in 1821 to 1825	1 in 45
— Denmark,	1751 to 1756	1 — 32	— 1819	1 — 45
— Germany,	1788	1 — 32	— 1825	1 — 45
— Prussia,	1717	1 — 30	— 1821 to 1826	1 — 39
— Wurtemberg,	1749 to 1754	1 — 32	— 1825	1 — 45
— Austria,	1822	1 — 40	— 1828 to 1830	1 — 43
— Holland,	1800	1 — 26	— 1824	1 — 40
— England,	1690	1 — 33	— 1821	1 — 58
— Great Britain,	1785 to 1789	1 — 43	— 1800 to 1804	1 — 47
— France,	1776	1 — 25½	— 1825 to 1827	1 — 39½
— Canton of Vaud,	1756 to 1766	1 — 35	— 1824	1 — 47
— Lombardy,	1769 to 1774	1 — 27½	— 1827 to 1828	1 — 31
— Roman States,	1767	1 — 24	— 1829	1 — 28
— Scotland,	1801	1 — 44	— 1821	1 — 59

Thus the mortality has diminished,—

In Sweden, nearly ⅓ in 61 years; in Denmark, 2-5ths in 66 years; in Germany, 2-5ths in 37 years; in Prussia, ⅓ in 106 years; in Wurtemberg, 2-5ths in 73 years; in Austria, 1-13th in 7 years; in Holland, ½ in 24 years; in England, 4-5ths in 131 years; in Great Britain, 1-11th in 16 years; in France, ½ in 50 years; in Canton of Vaud, ⅓ in 64 years; in Lombardy, 1-7th in 56 years; Roman States, ⅓ in 62 years.

For thirty years the mortality has been stationary in Russia and Norway; it has increased in the kingdom of Naples.

On the whole, there has been, for eighty years, a mortality of 1 individual in 36 throughout Europe, according to Süssmilch; our calculations do not exceed 1 in 40, according to the average of later years. On the continent of Europe there has, therefore, been a diminution of one-ninth in the mortality of the aggregate of the people, if we can rely on the German writer on statistics. We are, however, inclined to think, that, during his time, the mortality generally was less than one-thirtieth of the population, which supposes that it is more than one-third less at present in proportion to the augmentation of its population.

This gradual diminution of mortality arises from the same causes in the principal towns of Europe. The number of deaths, compared with that of the inhabitants at distant epochs, gives the following proportions:—

Paris.	in	1650	1 in 25 inhab.;	in	1829	1 in	32
London,	..	1690	1 .. 24 ..	..	1828	1 ..	55
Berlin,	..	1755	1 .. 28 ..	..	1827	1 ..	34
Geneva,	..	1560	1 .. 18 ..	..	1821	1 ..	43
Vienna,	..	1750	1 .. 20 ..	..	1829	1 ..	25
Rome,	in	1762-1771	1 .. 21 ..	..	1828	1 ..	31
Amsterdam,	in	1761 1770	1 .. 25 ..	..	1828	1 ..	29
Cambridge,	in	1811	1 .. 41 ..	..	1821	1 ..	58
Norfolk,	..	1811	1 .. 50 ..	..	1821	1 ..	59
Manchester,	..	1757	1 .. 25 ..	..	1821	1 ..	58
Birmingham,	..	1811	1 .. 30½ ..	..	1821	1 ..	43
Liverpool,	..	1773	1 .. 27 ..	..	1821	1 ..	41
Portsmouth,	..	1800	1 .. 28 ..	..	1811	1 ..	38
Petersburg,	..	1768	1 .. 28 ..	..	1828	1 ..	48
Stockholm,	in	1758-1763	1 .. 19 ..	..	1827	1 ..	26

The annual mortality has also diminished in Paris, more than $\frac{1}{3}$ in 80 years; in London, more than $\frac{1}{2}$ in 178 years; in Berlin, 1-5th, or nearly $\frac{1}{4}$, in 72 years; in Geneva, 3-5ths in 261 years; in Vienna, $\frac{1}{4}$ in 80 years; in Rome, $\frac{1}{2}$ in 63 years; in Amsterdam, 1-6th in 64 years; in Cambridge, 2-5ths in 10 years; in Norfolk, 1-5th in 10 years; in Manchester, 3-5ths in 64 years; in Birmingham, nearly 2-5ths in 10 years; in Liverpool, $\frac{1}{2}$ in 38 years; in Portsmouth, more than $\frac{1}{3}$ in 11 years; in Petersburgh, nearly 2-3rds in 40 years; in Stockholm, more than $\frac{1}{3}$ in 67 years.*

ANIMAL ORIGIN OF SULPHUR.

Professor C. Gemellaro, of Catania, in Sicily, has started a new theory on the subject of sulphur, the origin of which he attributes to animal substances. From a careful consideration of the nature of this combustible body, and repeated observations on the situations in which it is found, the Professor is led to regard as accidental its presence in volcanoes, in metallic veins, and in mineral waters; and that it is naturally and properly situated in blue clays and tertiary earths, where it is found with gypsum, salt, and lignites. He endeavours to show that where it exists in a pure crystallized form, it has been submitted to the action of subterranean fires. But the most essential point of this theory is, that it proposes to show that sulphur proceeds from the decomposition of the mollusca which remained in the valleys of the secondary earths when the sea retired, during the formation of the tertiary earths. The author does not think his hypothesis destitute of evidence. The existence of sulphur among the principles of the animal kingdom, its analogy with phosphorous, its combustibility, are all characteristics which indicate much rather an organic than a mineral substance. The strong developement of sulphurous hydrogen gas in animal putrefaction, the discovery of pure and crystallized sulphur in

* Abridged from Jameson's Journal, No. 32.

the places where this putrefaction has taken place on a large scale, and many other facts are alleged by Professor Gemellaro in support of his theory, that sulphur has its origin in animal substances.*

INQUIRIES RESPECTING THE WEIGHT OF MAN AT DIFFERENT AGES.

By M. Quetelet.†

The observations of M. Quetelet were made at Brussels, in the Maternal Hospice of St. Peter; he compares them with those made at Moscow and Paris, in similar hospices; and he finds little difference between the means obtained. Unfortunately, the Russian and French practitioners have not distinguished, with as much care as M. Quetelet, the sex, the stature, and the weight of children observed at their birth. This renders the results less capable of comparison. M. Quetelet found for sixty-three male children, and fifty-six female, newly born, the following quantities:—

	Weights.	Stature.
Male Children	7·057536 lbs. Avoird.	1·62732 feet.
Female ——	6·4179468	1·58467

The extremes are:—

	Boys.	Girls.
Minimum	5·1608232 lbs. Avoird.	2·4701376 lbs. Avoird.
Maximum	9·92466	9·36329

The mean weight, without distinction of sex, is 6·7377414 lbs. Avoird. It has been found at Paris, on 20,000 observations, 6·74656332 lbs. Avoird.‡

M. Quetelet has made similar inquiries concerning children from four to twelve years of age, in the schools of Brussels, and in the orphan hospital,—concerning young people in the colleges and in the medical school,—finally, concerning old men in the magnificent hospice which has been constructed in the same city for a period of four years. The results have been completed by observations made upon isolated individuals, taken by chance from the mean of all these data. The author has been able to construct tables, which shows the mean stature, the mean weight, as well as the minimum and maximum, at each age, and for both sexes. These tables show, that there exists at each age, and for each sex, a constant relation between the mean weight and the mean stature, from which the author has constructed another table, more exact than those which result directly from observations on the weights. It follows, from the mean stature formerly

* Printing Machine, No. 8.

† A pamphlet in 4to., of 43 pages. Brussels, 1833.—Translated by the Rev. William Ettershank.

‡ Dictionary of Medical Science.

observed by the author, for the whole population, or, at least, from a number of individuals much more considerable than in these last inquiries, and gives the mean weight corresponding to each stature, according to the observations which make the subject of this memoir.* The following is a table, which we may consider as exact for the whole population of Brussels, and which, for want of a table of this sort, calculated for other countries, may serve, at least, as an approximation for the Caucasian race, and in a temperate climate.

A SCALE OF THE DEVELOPEMENT OF THE STATURE AND WEIGHT.

Ages.	Males.		Females.	
	Stature.	Weight.	Stature.	Weight.
Years.	Imp. Feet.	lbs. Avoirdupois.	Imp. Feet.	lbs. Avoirdupois.
0	1·64045	7·05736	1·60764	6·4179468
1	2·29007	20·841786	2·26382	19·3861692
2	2·59519	25·0101432	2·56238	23·5324716
3	2·83469	27·5023356	2·79532	26·0026092
4	3·04468	31·3839804	3·00102	28·67124
5	3·24153	34·7804194	3·19559	31·6706928
6	3·43511	38·7982752	3·38261	35·28768
7	3·62539	42·984168	3·56305	38·6841192
8	3·81240	45·7857648	3·74351	42 0805584
9	3·99942	49·954122	3·92067	47·1040528
10	4·18314	54·0783696	4·09457	51·8728896
11	4·3636	59·768508	4·26189	56·570562
12	4·54404	65·7674136	4·43905	65·7674136
13	4·72122	75·8244024	4·60310	72·6485112
14	4·89838	85·4844048	4·76714	80·941116
15	5·07227	88·69745824	4·91807	89 035276
16	5·22975	109·5461916	5·03618	96·0927636
17	5·36099	116·559618	5·10179	104·3412588
18	5·43973	127·587018	5·13132	112·5456444
20	5·49222	132·4611288	5·15757	115·3024946
25	5·51191	138·7909564	5·17398	117·5079744
30	5·52503	140·378802	5·18054	119·8237284
40	5·52503	140 4229116	5·18054	121·8086604
50	5·49222	139·9597608	5·03946	123.8597568
60	5·37740	136·074312	4·97384	119·757564
70	5·32490	131·2701696	4·96728	113·6042748
80	5·29219	127·5429084	4·94103	108·884576
90	5·29219	127·5429084	4·93775	108·8183832

* The author cannot consider the results obtained in hospitals and public schools as very exact, as to the mean stature of the population, because inquiries made by him concerning a great number of individuals, have proved to him that the mean stature is a little more among individuals in easy circumstances than in the indigent population, who have recourse to hospices, hospitals, and gratuitous schools.

We see, from this table, 1st, That, at an equality of age, the male is generally heavier than the female; towards the age of twelve years only, an individual of either sex has the same weight. 2ndly, That the male attains the maximum weight about the age of forty years, and that he begins to lose, in a very sensible manner, towards his sixtieth year; that, at the age of eighty years, he has lost about 13·23288 lbs. Avoird., the stature being also diminished 2·75604 inches. 3rdly, That the female attains the maximum weight later than the male, towards the fiftieth year. 4thly, That when the male and the female have assumed their complete developement, they weigh almost exactly twenty times as much as at the moment of their birth, while their stature is only about $3\frac{1}{4}$ times beyond what it was at the same period.

Children lose weight during the three first days after their birth; at the age of a week they begin sensibly to increase; after one year, they have tripled their weight;—then they require six years to double the weight of one year, and thirteen to quadruple it.

To calculate the burden of an edifice, or a bridge, covered with a crowd, it is well to know, that the mean weight of an individual, whatever is the age or sex, is about 98·584956 lbs., that is, 103·65756 lbs. Avoird. for the males, and 93·7328 lbs. Avoird. for the females.

During the developement of individuals of both sexes, we may regard the squares of the numbers representing the weights, at the different ages, as proportional to the fifth powers of the statures. After the complete developement of individuals of both sexes, the weights are almost the squares of the statures.

The weights have varied, in the extremes, among individuals regularly conformed, from 1 to 2, whilst the stature has varied only from 1 to $1\frac{1}{3}$.

The inferior parts of the body are developed more than the superior. In a child, the head is equal to a fifth part; and in a full-grown man, to an eighth of the whole height of the individual. It appears, from a note at the end, that these proportions vary a little among different nations; but M. Quetelet, who, in his preliminary observations, explains very well the importance of these inquiries to the fine arts, does not appear to have written this work purposely for them. The activity which he has exhibited in his researches, makes us believe and hope that he will resume them at another time.*

HINT FOR NATURALISTS.

The fruits of many a naturalist's labours in remote and desolate regions have been lost, in consequence of no means being at

* Abridged from Jameson's Journal, No. 32.

hand of instantaneously stuffing the animals which he has caught. M. Comba, deputy curator to the zoological museum at Turin, has, however, suggested a method, which has at times enabled him to keep birds in a perfect state of preservation, with little trouble, and at no expense. He throws a noose round the bird's head, and after blowing in air through its beak, draws it tight: taking care to press the bird gently during the operation, in order to distribute the air uniformly and properly. Even during the hottest months in the year, this simple process has sufficed to preserve them eight or ten days. Whenever he shot the bird, he inserted wax in the orifice, and continued to press it deeper into it, whilst inflating the animal; this operation was repeated until every wound was so closed.*

THE HEDGEHOG.

One of the most interesting facts in the natural history of the hedgehog is that announced in 1831 by M. Lenz, and which is now confirmed by Professor Buckland. This is, that the most violent animal poisons have no effect upon it; a fact which renders it of peculiar value in forests, where it appears to destroy a great number of noxious reptiles. M. Lenz says that he had in his house a female hedgehog, which he kept in a large box, and which soon became very mild and familiar. He often put into the box some adders, which it attacked with avidity, seizing them indifferently by the head, the body, or the tail, and did not appear alarmed or embarrassed when they coiled themselves around its body. On one occasion, M. Lenz witnessed a fight between the hedgehog and a viper. When the hedgehog came near and smelled the snake, for with these animals the sense of sight is very obtuse, she seized it by the head, and held it fast between her teeth, but without appearing to do it much harm; for having disengaged its head, it assumed a furious and menacing attitude, and hissing vehemently, inflicted several severe bites on the hedgehog. The little animal, however, did not recoil from the bites of the viper; or, indeed, seem to care much about them. At last, when the reptile was fatigued by its efforts, she again seized it by the head, which she ground between her teeth, compressing the fangs and glands of poison; and then devouring every part of the body. M. Lenz says that battles of this sort often occurred in the presence of many persons, and sometimes the hedgehog has received eight or ten wounds on the ears, the snout, and even on the tongue, without appearing to experience any of the ordinary symptoms produced by the venom of the viper. Neither herself nor the young which she was then suckling, seemed to suffer from it. This observation agrees with that of Pallas, who assures us that the hedgehog can eat about a

† Printing Machine, No. 6.

hundred cantharides, without experiencing any of the effects which this insect, taken inwardly, produces on men, dogs, and cats. A German physician, who made the hedgehog a particular object of study, gave it strong doses of prussic acid, of arsenic, of opium, and of corrosive sublimate, none of which did it any harm. The hedgehog, in its natural state, only feeds on pears, apples, and other fruits, when it can get nothing it likes better. Its ordinary food consists of worms, slugs, snails, frogs, adders, and sometimes rats and mice.*

ZOOLOGICAL SOCIETY.

Notes abridged from the Proceedings of the Committee of Science and Correspondence.

THE BARNACLE.

On October 22, 1833, Mr. Gray gave some account of the reproduction of cirrhipeda, founded on observations made by him on balanus cranchii, Leach, during a recent visit to the coast of Devonshire. In illustration of his remarks he exhibited an adult of that species with the eggs attached to the body at the base of the shell, and the young *in ovo*. He also exhibited numerous very minute individuals of Bel. vulgaris affixed to rock.

He described the mode of reproduction as ovoviviparous. On opening under water, after they had been preserved in spirits, the eggs attached to the body of the adult, each was found to contain a perfectly developed animal, which occupied nearly the whole of its cavity. The form of the young barnacle at this period of its existence is ovate, rather tapering above, and truncated and ciliated at the tip: it is furnished with three pairs of arms along the sides, the base of each arm being two-jointed; the lower pair of arms has only one elongated process, while each of the two upper pairs has two fusiform, thick, articulated, and ciliated processes, similar to those of the anterior part of the perfect animal, but less elongated. From the adult it differs chiefly in having a smaller number of feet, and in the less developement of the hinder part. It is also destitute of shelly covering, which is probably not formed until the young animal becomes fixed. In very small attached individuals of the common barnacle the shell is rather soft, transparent, and horn-coloured.

In the absense of shell from the animal in the egg, an additional evidence is furnished of the affinity of the cirrhipedes to crustacea rather than to mollusca: the fœtus in the latter class being covered by a shell at a very early stage of its embryo growth. The existence in the young animal of a smaller number of arms than that found in the adult is also analogous to the corresponding fact which has been observed in several of the branchiopodous crustacea. A similar fact has recently been noticed by Dr. Nordmann as occurring in lernæa.

Mr. Gray remarked that he had been the more induced to call the attention of the society to the subjects which he exhibited, on account of his observations being at variance with those recorded by Mr. J. V. Thompson in the fourth memoir of his "Zoological Researches." The young of balanus is there described as being, when one-tenth of an inch

* Printing Machine, No. 6.

in length, a free swimming animal, resembling cyclops in its general form, and having pedunculated eyes: and it is stated that it then throws off its bivalve-shell-like envelope, together with the greater part of the black colouring matter of the eyes, becomes fixed and covered with calcareous matter, and is changed into a young barnacle, such as is described by Pennant as balanus pusillus, the arms at the same time acquiring the usual ciliated appearance. In Mr. Gray's specimens of the young, on the contrary, the general form of the adult is found, and the arms are ciliated while it is still in the egg, its total length being less than one-fiftieth of an inch. Of this length it is also by no means uncommon to find common barnacles attached.

Mr. Gray added that on examining the eggs which are found around the base of the animals of pentalasmis, Leach, and otion, Ej., he had observed indications of the existence of young similar to the adult. They were not, however, sufficiently developed to enable him to describe them with precision.

Mr. Gray also called the attention of the society to a fact connected with the history of some of the marine gasteropodous mollusca, which he had observed on the same occasion with the young of the balani. It is well known that the animals of terrestrial shells are torpid during the winter in cold and temperate climates, and during the dry season or summer in tropical regions; but it had not been previously remarked that a similar state occurs in those of marine shells. Mr. Gray found that many individuals of littorina petræa, and some of Litt. rudis, were in this condition during his stay at Dawlish. They were attached to the rocks several feet above the reach of the highest autumnal tides; their foot was entirely retracted; and a membranous film was spread between the rock and the edge of the outer lip of the shell: the gills were only moist, the branchial sac being destitute of that considerable quantity of water which exists in it in those of the same species which are adherent to the rock by their expanded foot. In this torpid condition, the individuals observed by Mr. Gray continued during the whole of his stay, which lasted for more than a week. On removing several of them and placing them in sea-water, they recovered in a few minutes their full activity.

Mr. Gray further stated that he had on the same occasion observed that the animal of rissoa parva has the power of emitting a glutinous thread, by which it attaches itself to floating sea-weeds, and is enabled, when displaced, to recover its previous position. A similar property, he remarked, was long since observed in one of the land mollusca, a species of limax, Linn.; and it has recently been recorded by M. Sander Rang as occurring in a marine genus of mollusca, to which he has given the name of litiopa. Mr. Gray added his belief that it would probably be found to be common to many species of marine mollusca.

ADDITIONS TO THE MENAGERY.

Nov. 12.—The Secretary called the attention of the Society to several animals which had recently been added to the menagery. They included an ursine opossum, dasyurus ursinus, Geoff., an animal known to the colonists of Van Diemen's Land by the appellation of the *native devil;* a secretary vulture, gypogeranus serpentarius, Ill., presented to the Society by Lieutenant-General Sir Lowry Cole; and two crowned cranes, presented by the same distinguished officer, on his return from the government of the Cape of Good Hope.

Referring more particularly to the latter, he brought under the notice

of the meeting specimens from the Society's museum of crowned cranes from Northern and from Southern Africa, with the view of illustrating the characters which distinguish as species the birds from these several localities. Their specific distinction, he stated, on the authority of Professor Lichtenstein, had been pointed out, nearly thirty years since, by the Professor's father, who gave to the Cape bird the name of grus regulorum: this distinction has, however, not been generally known among ornithologists, although to those connected with the Society it has for some time been familiar, from observation both of numerous skins and of living individuals. In the bird of North Africa, for which the specific name of pavoninus will be retained, the wattle is small, and there is much red occupying the lower two-thirds of the naked cheeks: in that of South Africa the wattle is large, and the cheeks are white, except in a small space at their upper part: the neck also is of a much paler slate-colour than that of the North African species. He added that the latter characters had been observed to be permanent in an individual presented to the Society, in April, 1829, from the collection of the late Marchioness of Londonderry, and which is still living at the gardens: they exist also in both the individuals presented by Sir Lowry Cole.

The two species may be distinguished as anthropoïdes pavoninus and anthrop. regulorum.

Mr. Gray took occasion to remark that the oval form of the nostrils in the crowned cranes, added to other distinguishing characters which have frequently been pointed out, might be regarded as indicating a generic difference between them and the Demoiselle and Stanley cranes, in which the nostrils have the lengthened form usual in the genus grus, a genus from which they scarcely differ except in the comparative shortness of their bill. For the group, including the crowned cranes, the name of balearica might, he thought, be retained; and that of anthropoïdes be appropriated to the one comprehending anth. virgo, Vieill., and anth. paradisæus, Bechst.

DISSECTION OF A PUMA.

Nov. 12.—Notes by Mr. Martin of a dissection of a *Puma*, *Felis concolor*, Linn., which recently died at the Society's gardens, were read; from which the following are extracts.

Among animals of the feline genus so few points of anatomical difference are found to exist, that the notes of the dissection of one species (allowance being made for relative magnitude,) are closely applicable to that of almost any other. We can, therefore, only expect to trace out minor differences in structure; and these not among organs essentially connected with the habits and general characteristics of the genus, but with habits peculiar and specific. Hence perhaps we find in this group the greatest difference to obtain in the organs of voice; a circumstance which might naturally be expected, as some according modification must necessarily produce the deep-toned roar of the lion, the snarl of the jaguar, and the hissing cry of the puma.

The distance between the base of the tongue and the larynx in the lion, has been brought more than once under the notice of the Society; in the jaguar, this distance, comparatively speaking, is nearly as great; but in the puma, an animal equal, or nearly so, in size to the jaguar, the distance is reduced to an inconsiderable space, an inch or an inch and a half, according as the tongue is more or less protruded. In addition to this, it is worthy of observation, that the circumference of the larynx in

the puma is also very inconsiderable; compare, for example, the larynx of the jaguar with that of the present animal, both natives of the wilds of the American continent. In the jaguar we find a larynx indicating from its general magnitude considerable depth in the intonations of the voice, whereas, in the puma, if we take either its diameter, or its distance from the termination of the palate and base of the tongue, we are led to expect neither the roar of the lion nor the growl of the jaguar, but the shrill tones of an animal, ferocious indeed, but of all others of the genus perhaps the most stealthy and insidious. I am the more inclined to call attention to these differences, because I think that I have observed a kind of mutual correspondence between the voice and the habits of animals, a point well worthy minute investigation, and on which, on a future occasion, I design to offer a few observations.

NEW BAT.

Nov. 26.—Specimens were exhibited of a Bat, which had recently been obtained by the Society from the collection of the late Rev. Lansdown Guilding, Corr. Memb. Z. S.

Mr. Gray, in directing the attention of the meeting to them, remarked on them as constituting the type of a new genus, for which he proposed, on account of the shortness of the nose-leaf, the name of BRACHYPHYLLA.

This genus agrees with *Glossophaga* in most of its characters, and has the same warty-edged slit on the middle of the under lip, and the same elongated tongue: but it differs in the form and structure of the nose-leaf; in the tongue being covered with rough and closely-set warts, which are not placed, as in that genus, in oblique plaits; and in the shape of the central upper incisors, which are elongated and conical, and not short and flat-topped and bevel-edged. In the form of its upper middle incisors it agrees with *Vampyrus soricinus*, Spix; but it is distinguished from that, and from all the other *Vampyri*, by the structure of its under lip and tongue, and by the hinder part of the nose-leaf being separated by a groove from the skin of the forehead. Its interfemoral membrane is somewhat like that of *Vamp. Spectrum*, Geoff., and has the same muscular bands.

This Bat inhabits caves in St. Vincent's, according to the late Rev. Mr. Guilding, who proposed to call it *Vespertilio Cavernarum*.

MANELESS LION OF GUZERAT.

Dec. 10.—The skins were exhibited of a *Lion* and *Lioness* killed in Guzerat by Captain Walter Smee, who, at the request of the Chairman, stated that they were selected from among eleven obtained by him in the same country, eight of which he had brought with him to England. The *Lion* is distinguished from those previously known, by the absence of a mane from the sides of the neck and shoulders, the middle line of the back of the neck being alone furnished with longer hairs, which are erect like those in the same situation in the *Cheetah*, *Felis jubata*, Schreb. The under surface of the neck has long, loose, silky hairs, and there is a tuft at the angle of the anterior legs.

Captain Smee remarked, that the existence in Guzerat of a *maneless Lion* had been known thirty years since by Colonel Sykes, and that Olivier had seen at Bagdad a similar animal, which was understood to have been brought thither from Arabia; but that hitherto, he believed, no skin of such a race had fallen under the observation of naturalists in Europe. Besides the absence of the extensive mane, it has to distinguish

it from the ordinary *Lion*, a somewhat shorter tail, furnished at its tip with a much larger brush.

Regarding it as a strongly marked variety of the *Lion* hitherto known, Captain Smee proposed for it the following characters :—

Felis Leo, Linn., Var. Goojratensis. *Jubâ maris cervicali brevi, erectâ ; caudæ flocco apicali maximo nigro.*

Hab. in Guzerat (et in Arabiâ ?) [et in Persiâ ?].

A male measured, including the tail, 8 feet 9½ inches in length. His total weight, exclusive of the entrails, was 4½ cwt.

The *maneless Lion* extends in Guzerat through a range of country about forty miles in length, where it is known as the *Ontiah Baug*, or *Camel Tiger*, a name derived from its colour. In the hot months it is found in the low, bushy, wooded plains that skirt the Sombermutty and Bhardar rivers, from Ahmedabad to the borders of Cutch. It is destructive to cattle, but does not appear to attack man. When struck by a ball it exhibits great boldness, standing as if preparing to resist its pursuer, and then going off slowly, and in a very sullen manner ; unlike the *Tiger*, which, on such occasions, retreats springing and snarling.

Captain Smee entered into various details respecting the animals exhibited by him, comprehending the heads of a paper "On the *maneless Lion* of Guzerat," which he had prepared for the Society.*

THE LION AND THE TIGER.

January 14, 1834.—Several *crania* were exhibited of the Lion and of the Tiger, forming part of the Society's Museum, on which Mr. Owen explained the distinguishing characteristics of that part of the osseous system of these two large species of *Felis*. He adverted, in the first instance, to those pointed out by Cuvier in the "Ossemens Fossiles," and remarked on the first of them,—the straightness of the outline in the Lion from the mid-space of the postorbital processes to the end of the nasal bones, in one direction, and to the *occiput* in the other,—as not being in all cases available : the second distinction,—the flattening of the interorbital space in the Lion, and its convexity in the Tiger,—he regarded as being more constant and appreciable than the one just mentioned. There is, however, a distinction, which he believes has never been published, which is well marked, and which appears to be constant ; for it is found to prevail throughout the whole of the skulls of these animals which he has had opportunities of examining, including ten of the Lion, and upwards of twenty of the Tiger. It consists in the prolongation backwards, in the *cranium* of the Lion, of the nasal processes of the maxillary bones to the same transverse line which is attained by the coronal, or superior ends of the nasal bones : in the Tiger the nasal processes of the maxillary bones never extend nearer to the transverse plane attained by the nasal bones than ⅓rd of an inch, and sometimes fall short of it by ⅔rds, terminating also broadly in a straight or angular outline, just as though the rounded, and somewhat pointed ends, which these processes have in the Lion, had been cut off. Minor differences, Mr. Owen remarked, exist in the form of the nasal aperture, which in the Tiger is disposed to narrow downwards, and become somewhat triangular, while in the Lion its tendency is towards a square shape ; in the deeper sinking, in a longitudinal depression, of the coronal extremities of the nasal bones in the Tiger than in the Lion ; in the bounding of this depression above in most

* In the Philosophical Magazine, No. 23, it is added that a maneless lion also exists in Persia.

of the Tigers' *crania* by a small but distinct semilunar ridge, which is not found in those of the Lion; and in the larger comparative size, chiefly in their transverse diameter, of the infraorbital *foramina* in the Lion. These *foramina*, it is curious to observe, are double either on one or both sides in the only four *crania* examined of Lions which were known to be Asiatic, while in all the others the *foramen* was single on each side.

CAPYBARA—BROWN COATI—MACAQUE MONKEY.

February 11.—Portions were exhibited of the *viscera* of a *Capybara*, *Hydrochærus Capybara*, Erxl., taken from an individual which recently died in the Society's Menagery. They consisted of the stomach, the enormous *cæcum*, and the *fauces*. In calling the attention of the meeting to the latter parts, Mr. Owen availed himself of the opportunity to demonstrate the structure first observed in them by Mr. Morgan, by whom it has been described and figured in the lately published part of the "Linnæan Transactions." The constriction of the hinder part of the soft palate, which prevents any but minutely divided substances from passing into the *pharynx*, and which was first observed in the *Capybara*, is found in many other *Rodents*, but does not obtain in the whole of the animals of that order.

Mr. Martin also exhibited a preparation of aneurism of the *aorta*, obtained from a *brown Coati*, *Nasua fusca*, F. Cuv., sent to the Society for *post-mortem* examination by J. H. Lance, Esq. He stated that this disease appeared to be rare among Quadrupeds, no previous instance of it having occurred to him among more than a hundred individuals of various orders which he had dissected within the last few years.

A preparation was exhibited of a young *common Macaque Monkey*, *Macacus cynomolgus*, La Cép., which was born at the Gardens on the morning of the 25th of January, but was dead when first noticed by the keeper. It is the first instance that has occurred in the Society's Menagery of the birth of any Monkey of the Old Continent.

BIRD-CATCHING SPIDER.

Feb. 11.—In a paper on two genera of Spiders, Mr. W. S. Macleay referred to Madame Merian's description of the metamorphosis of *Ur. Leilus*, and to her figure of its *larva*; both of which he regards as unworthy of credit. He then passes to her account of a bird-catching Spider.

The story of a Spider which catches and devours birds, had, Mr. Macleay believes, its origin with Madame Merian. Oviedo, Labat, and Rochefort, make no mention of any Spider as possessing such habits, the two latter writers going no further than the statement, that in the Bermudas there exists one which makes nets of so strong a construction, as to entangle small birds. Madame Merian, however, went the length of asserting that one Spider not only caught, but devoured small birds; and figured the *Mygale avicularia*, Walcken., in the act of preying on a Humming-bird. Now the *Mygale* does not spin a net, but resides in tubes under ground, and in all its movements keeps close to the earth; while Humming-birds never perch except on branches. The food of *Mygale* consists of *Juli*, *Porcelliones*, subterranean *Achetæ*, and *Blattæ*: a living Humming-bird and a small *Anolis*, placed in one of its tubes, were not only not eaten by the Spider, but the latter actually quitted its hole, which it left in the possession of the intruders. The largest Spider of the West Indies that spins a geometrical web is the *Nephila clavipes*,

Leach; and its net may, perhaps, occasionally, be strong enough to arrest the smaller among the Humming-birds: but it is not likely that the Spider would eat the birds. A small species of *Sphæriodactylus*, Cuv., introduced into one of these nets, was enveloped in the usual manner by the Spider; but as soon as the operation was completed, the Spider lost no time in cutting the line and allowing her prisoner to fall to the ground. Mr. Macleay, consequently, disbelieves the existence of any bird-catching Spider.

CRYPTOPROCTA.

February 25.—A letter was read, addressed to the Secretary by M. W. Bojer, Corr. Memb. Z.S., and dated Mauritius, Nov. 15, 1833. It referred principally to the animal from Madagascar, which was transmitted in the spring of last year to the Society by the late Mr. Telfair, and which was brought by Mr. Bennett on April 9, 1833, under the notice of the Society as the type of a new genus, for which he proposed the name of *Cryptoprocta*, on account of its possessing an anal pouch, and being thereby distinguishable from *Paradoxurus*, F. Cuv. One of the habits of the *Cryptoprocta ferox* indicated, during the life of the animal, the existence of this pouch: when violently enraged, and it was apt to become exceedingly ferocious on the sight of a morsel of flesh, "it frequently gratified the persons present with, not an odoriferous, but a most disagreeable smell, very like that of *Mephitis*." Other particulars were contained in the letter, which are given in the "Proceedings."

BIRDS OF NORTH AMERICA.

Feb. 25.—Numerous specimens were exhibited of birds collected in North America, principally in the United States, by George Folliott, Esq., and presented by him to the Society. At the request of the Chairman, Mr. Gould brought them severally under the notice of the meeting. His principal object being to illustrate, so far as these birds were concerned, the geographical distribution of allied or identical species, he directed his observations chiefly to the determination of those North American birds which seemed to him to be referrable to European species, and of those which, having been generally considered as identical with European, appeared, on direct comparison, to present differences in form and colouring.

The common Turnstone of Europe, *Strepsilas collaris*, Temm., appears to be not only identical with the Turnstone of North America, but to be spread, without any tangible variation, over almost every portion of the globe. The Sanderling, *Calidris arenaria*, Temm., and the Knot, *Tringa Canutus*, Linn., are also identical in both continents; as is the great white Heron or Egret, *Ardea Egretta*, Temm. The common Tern or Sea Swallow of England, *Sterna Hirundo*, Linn., occurs equally in North America. The common Crow, *Corvus Corone*, Linn., is also identical in both continents.

With respect to the Whimbrel, *Numenius phæopus*, Temm., and the little Sandpiper, *Tringa Temminckii*, Mr. Gould stated himself to be unable to determine as to their identity without the comparison of more specimens from America than he had yet been able to obtain for the purpose of examination.

The Cross-bill of North America Mr. Gould showed to be very distinct from that of Europe, the *Loxia curvirostra*, Linn.; it is one-third less in all its proportions, and is somewhat less brilliant in colouring.

The Ring Dottrel of North America is also specifically distinct from that of Europe, the *Charadrius Hiaticula*, Linn.; independently of differences in admeasurement, its semipalmated foot will always serve to distinguish it.

In addition to the birds that have been already mentioned, Mr. Folliott's collection contained a series of the *Sylviadæ* of the United States, several Fly-catchers, the *Orphea rufa*, &c. &c.

NEW RADIATED ANIMAL.

Feb. 25.—Mr. Gray exhibited specimens of the shelly covering of a Radiated animal, allied to the *Echinidæ* and the *Asteriidæ*, which he regarded as the type of a new genus, and for which he proposed the name of *Ganymeda*.

This genus is very nearly allied to the fossil described by Dr. Goldfuss, in his beautiful work on Petrifactions, under the name of *Glenotremites paradoxus* (tab. 49, f. 9, and t. 51, f. 1), with which it agrees in external appearance and form, in the possession of a sunken space on its upper surface, and in having only a single inferior pentagonal mouth. It differs from *Glenotremites* by being unfurnished with ambulacra running from the angle of the mouth to the margin, by being unprovided with conical cavities between those near the mouth, and by having in the flattened disc on the back a central quadrangular impression instead of the pentagonal star of that genus.

Dr. Goldfuss described the glenoid cavities on the surface as giving attachment to spines similar to those of the *Turban Echini*, (*Cidaris*, Lam.), and states that the under surface is covered with very small tubercles to which he believes spines were attached. The cavities on the surface of *Ganymeda* and the pits in them have very much the form of those figured by Dr. Goldfuss in his fossil, but I cannot regard them as being fitted for the attachment of spines: they have much more resemblance to the mouths of cells. So great, indeed, is this resemblance, that I entertained doubts whether the whole mass might not be a congeries of cells like the *Lunulites*, rather than the case of a single body, until I considered that it was impossible, from its form, that it could increase in size with the growth of the animal, and that its exceeding regularity proved that it must be the formation of a single creature.

I am induced to consider these two genera, though differing in the above-stated particulars, as forming a family or order between the *Echinidæ* and the *Asteriidæ;* allied to the latter in having only a single opening to the digestive canal, and agreeing with the former in form and consistence, but differing from it in not being composed of many plates.

I only know two specimens of this genus, which I believe were found on the coast of Kent, as I discovered them mixed with a quantity of *Discopora Patina* which I collected several years ago from *fuci* and shells on that coast. The specimens are $\frac{1}{8}$ of an inch in diameter.

I propose to call the species *Ganymeda pulchella*.

NEW TORTOISE.

March 11. — Specimens and drawings were exhibited of a fresh-water tortoise, forming part of the collection of Mr. Bell, by whom it was described as the type of a new genus, for which he proposed the name of *Cyclemys*.

Mr. Bell regards this tortoise as supplying a link in the connecting series of the land with the fresh-water families which has hitherto been

mer, and the fruit got to its full size in October, when it turned brown, and dropped off. The stem of the plant is perfectly straight to the height of sixteen feet, and it measures seventeen inches in circumference at the bottom. The lower branches have been pruned off, and some of the upper ones brought down nearly to the stem, which gives the whole plant a very fine appearance. The leading branches have been shortened in twice ; and the circumference of the extreme branches is now 32 feet. ; many of the leaves are 16 inches long, and 5½ inches wide. Had the plant been planted in the centre of the house, it would have reached the highest part of the roof, which is 23 feet. The fruit are small cylindrical bodies, about half an inch long, and a quarter of an inch in diameter, terminating abruptly at both ends, with a rough surface of a greenish brown colour. In no point of view can they be considered as ornamental. The tree from which they were taken, must, however, be one of the finest objects of the kind in the country.—*Ibid.*

Brugmansia suaveolens.—A magnificent specimen is at Lewiston, near Sherborne. It is 17 feet high, and 45 feet in circumference ; the trunk, at the surface of the soil, is 18 inches in circumference, and at 4 feet from the ground, where it begins to branch off, 13 inches. It had upwards of 600 blossoms fully expanded, and a great many unexpanded ; the flowers average one foot long, and eight inches in diameter ; and their beauty and fragrance are beyond conception. The plant occupies the centre of a circular conservatory. It was planted there when about five feet high, seven years ago, in a mixture of loam, peat, and vegetable mould. It has flowered equally well for the last four years.—*Ibid.*

Apples.—A Nonsuch, grown in the garden of Captain Carter, at Richmond, in Yorkshire, measured 11½ inches in circumference ; and a Hawthornden, in the same garden, 11 inches.—*Newcastle Courant, Sept.* 6.

Preservation of dried Sweet Herbs.—Mr. Lindsey, gardener to the Duke of Devonshire at Chiswick, has made a great improvement in the mode of preserving dried sweet herbs ; such as thyme, marjoram, savory, sage, &c. After drying them in the usual manner in the shade, he puts each sort into a small box, 8 in. or 10 in. long, by 5 in. or 6 in. broad, and 6 in. or 8 in. deep ; and by means of boards of the size of the interior length and width of the box, and a screw-press, he presses the herbs into cakes, or little trusses, about 8 in. long, by 5 in. wide, and 2 in. thick. These are afterwards carefully wrapped up in paper ; and, being kept in a dry place, are found to retain their aroma, in as perfect a state as when they are put in the press, for at least three years.—*Gardener's Mag.*

To preserve Celery through the Winter.—Get up the celery on a fine dry day before it is injured by frost, cut off the leaves and roots, and lay it in a dry, airy place for a few days ; then remove it to a cool cellar, where it will be quite secure from frost, and pack it up with sand, putting layers of celery and of sand alternately.—*Ibid.*

Forcing Asparagus. — Asparagus is obtained in winter and early spring on uncovered dung beds, or on dung beds covered with glazed frames, by various methods ; of which the two following are those most generally used by the gardeners in the neighbourhood of Paris :—*Forcing White Asparagus.*—By this mode, asparagus is forced without removing the plants from their places in the open garden. The asparagus beds are laid out four feet wide, and paths, two feet wide, are left between them. The beds are made up, and manured with more than ordinary care, and

they are planted with four rows of plants; the rows being a foot apart (which leaves a space six inches wide between the outside row and the path, on each side of the bed), and the plants being nine or ten inches from each other in the row. The beds are carefully attended to, and cultivated during three years. Forcing is commenced in the fourth year, from December till March, according to the demand. The paths are hollowed out to the depth of eighteen or twenty inches, and the earth taken from them is thrown on the beds: the paths are then filled up with hot dung well trodden down, and glazed frames are put upon the beds, the frames being filled up to the glass with hot dung. The beds are raised three or four inches by the earth thrown upon them from the paths, and this is done to increase the length of the blanched shoots of asparagus. Twelve days after putting on the frames, a little of the dung in them is lifted up with the hand, in order to see whether the asparagus has begun to push: when it has, all the dung is taken from the inside of the frames, and the heads of the asparagus are cut as they attain the desired size. The sashes should not be more than six inches from the soil. The heat is kept up by renewing and stirring the dung in the linings, and by covering the frames with straw during the night, and in bad weather. In April, the frames are taken away, and the dung is removed from the paths, which are again filled with the earth which was thrown on the beds. The plants are then allowed to rest a year; but the second season they may again be forced, and so on alternately, as long as the produce is satisfactory. The asparagus thus obtained is called white asparagus by the Persian gardeners, as the heads have very little colour; but there is another kind, which is called green asparagus, which may be raised by the following method:—*To force Green Asparagus.*—From December to March, beds of hot dung, four feet wide and two feet high, are made successively as required; and these beds are covered three or four inches deep with vegetable mould, or rich black earth; on this are placed the frames, which are covered with straw, to increase the heat. When the beds are in a proper state, they must be planted with asparagus plants three or four years old; or with old plants from beds about to be destroyed, the roots having been first reduced to an equal length, say eight or nine inches. The roots are placed in the beds on end, so close together as to support each other, and so as to have their buds all nearly of the same height, mould being pressed between the plants with the hand, so as to fill up all vacuities. The frames and sashes are then put on, and the asparagus soon begins to push. The shoots are small, but very green. As the roots do not continue throwing up shoots more than a fortnight or three weeks, it is necessary to make but few beds at a time, to renew them often. This green asparagus is chiefly used in Paris, cut into small pieces, as a substitute for green peas. —*Le Bon Jardinier for* 1834.—*Translated in the Gard. Mag., No.* 49.

Destroying Insects by Decoctions of Chamomile Flowers.—In the *Irish Gardener's Magazine* it is said, not only that decoctions, or the leaves dried and powdered, of the common chamomile, will destroy insects; but that "nothing contributes so much to the health of a garden, as a number of chamomile plants dispersed through it. No green-house, or hot-house, should be without chamomile in a green or in a dried state; either the stalks or flowers will answer. It is a singular fact, that if a plant is drooping, and apparently dying, in nine cases out of ten, it will recover, if you place a plant of chamomile near it."

A great Improvement in the Garden Engine has recently been made by Mr. Read, (inventer of the improved syringe). In consequence of having a reserved power of condensed air, he can throw the water in a fine shower to a much greater distance than can be done by the common engine, and this with much less labour to the operater.—*Gard. Mag.* 49.

The Tea Plant.—In a speech delivered by Sir G. T. Staunton, March 18, he observes, that the name congou, bohea, and souchong, were not given to teas by the Chinese, who merely described their teas as inferior, middling, and superior. He adds, that all the black teas imported into this country, with a very small exception, were produced by the same plant, and in the same district, viz., that of Bohea. The literal meaning of the term "congou," in the Chinese, is "prepared or manufactured," and the meaning of "souchong," is "selected."—*Morning Post.*

Prize Gooseberries.—Gooseberry bushes are only found to produce fruit suitable for exhibition when they are four or five years old; because the fruit after that age decreases in size, though it increases in number. Gooseberries rarely, if ever, produce fruit of a very large size for more than two years together; and generally only one season. The mode usually now practised is, to take a gooseberry tree out of the nursery in its second year. The next year (being the first after transplanting) it is not allowed to bear any fruit; but the year following, that is, in the fourth year of its age, it is in its prime, and will produce its largest and finest fruit. We seldom hear of the same tree producing equally fine fruit for even two years in succession: the Bumper, which produced the largest berry in 1832, weighing 30 dwts. 18 grs., in 1833 did not produce any berry weighing above 22 dwts. 5 grs.; and many other examples might be given.—*Gardener's Mag., No.* 48.

To Secure a Supply of Young Carrots throughout the Year.—In the first week of August, sow a crop of the short-horn kind in a cold frame, and a crop to succeed it in the third week of August, also in a cold frame, the latter of which will be at least two months after the first in coming in. Early in January sow a crop on a slow hot-bed, under glass; and early in February, on a slow hot-bed, under hoops and mats; in the succeeding months, sow occasionally in the open ground. A question may arise as to the necessity of sowing in frames in the month of August: it must, therefore, be understood, that these crops are to serve through all the winter; and, therefore, it will be found that glass will be of essential service, as the weather grows cold; and not only glass, but a covering of mats also will be necessary, during the night, in severe weather. One thing, however, must be attended to in the use of glass; namely, to be careful to give sufficient air at all times, to keep the plants from getting drawn.—*Gardener's Mag., No.* 48.

Steam-digging Machine.—M. Wronski, a celebrated mathematician at Paris, has, according to the Paris papers, discovered a new system of applying steam to carriages, digging machines, hoes, picks, ploughs, &c.; so superior to any thing hitherto known, that a French company has bought his patent for four millions of francs.—*Le Temps.*

The Zante Currant.—The fruit of this plant is generally believed to be seedless; however, this is not altogether correct. Generally there is found a berry in each bunch, near its upper part, twice, and often thrice, the size of the others, which only contains a single seed. This is curious, and has escaped common observation.—*Gard. Mag., No.* 52.

Grafting Pears on the Extremities of the Shoots of old Pear Trees trained on Walls, Mr. Saul informs us, is practised with so much success by an eminent clergyman in the neighbourhood of Lancaster, that the scions form blossom, buds, and spurs, the same year that the graft is put on, and produce fruit the year following. The scions are inserted either on the points of the shoots, or the shoots are shortened back, according to the room there may be for the shoots produced by the scion; these shoots are either trained straight forward, or wholly, or in part, turned back towards the bole of the tree. More than this, an intelligent gardener does not require to be told.—*Gardener's Mag., No.* 48.

Magnolia Conspicua.—A fine specimen, in a pot, was exhibited at the Horticultural Society's meeting, on March 4, when it was stated that the number of blooms open at one time in the nursery, the day before, was estimated at 18,000. Why this tree of white tulip-like flowers, now so cheap, should not be more common, we are utterly at a loss to understand. It will grow even in the smoke of London.—*Gard. Mag., No.* 49.

MISCELLANEOUS ARTS.

New Method of Staining Rooms.—A new mode of staining paper, or ornamenting rooms, has just been adopted in Paris. By means of wet, or liquefied sawdust, a very beautiful appearance is given to wainscoting, equal, it is said, to that caused by the most expensive paper.—*Athenæum.*

Cashmere Shawls.—At Kilghiet, in the district of Soudah, twenty days' journey from Cashmere, is held the great mart for the worsted employed in the manufacture of those soft stuffs used as shawls, and almost as much in demand by the elegant females of Europe, as the more voluptuous inmates of the East. There are two qualities of worsted: that which is most readily dyed is white; the other species is of a light ash colour, which cannot, without some difficulty, be rendered sufficiently white, and is more frequently used of the natural colour. One goat rarely furnishes more than two or three pounds of worsted per year. After the shearing, the two qualities are carefully separated; after which, they undergo repeated washings in rice water. Great importance is attached to the operation of washing; and the Cashmerians attribute much of the delicacy of their unrivalled productions to the fine qualities of the waters of their valley. At Kilgheit, the worsted of Cashmere is sold in the rough at about 2*s.* the pound; but, as the preparation and washing occasions a loss of 50 per cent., it is sold ready for the loom at 6*s.* the pound. The form, size, and border of the shawls, vary according to the different markets for which the manufacturer designs them.—*Translated from a Turkish Newspaper.—Athenæum*, No. 371.

Mr. Weekes's Mode of Heating by Hot-Water is spreading extensively, both in the neighbourhood of London and in the country; apparatus being now in course of erection, by the inventer, in no fewer than twelve different counties. In all, the principle is the same; viz., that of heating the water in cast-iron pipes, which form a casing to the fire-place, on each side, above, and sometimes even below, the fire. The water, being

heated, is raised to a small cistern, elevated five, six, or any number of feet above the fire; whence it descends, and circulates either on a level with the fire-place, or above or below it. Mr. Weekes has recently taken out a patent for applying his mode of circulating hot-water to cooking, in a new description of kitchen range, which will be found noticed in the *Architectural Magazine*, vol. ii., p. 44.

Tea and Coffee.—The following interesting facts have been elicited during recent discussions at the Medico Botanical and London Medical Societies, and are reported in the *Literary Gazette*:—Dr. Uwins and Mr. Cole thought that much evil resulted from the excessive use of tea and coffee; taken in excess, they were found to operate as powerful and decided stimulants; by their action on the nervous and sanguiferous systems, they occasion a temporary flow of spirits, and banish all desire for sleep; this state of excitement, however, speedily subsides, and is followed by langour and palpitation of the heart, irregular breathing, and uneasiness in the region of the præcordia; in some constitutions the symptoms are still more violent—the pulse becomes irregular and feeble, the extremities cold, pain and an uneasy sensation are felt at the pit of the stomach, and even syncope follows. Shortly after, a desire for sleep presents itself; but the slumbers are troubled and uneasy, and the face and limbs suffer from spasmodic twitchings. These consequences of the over-use of tea and coffee are to be accounted for by referring to the habits and idiosyncracy of the individual; and in such cases, the only relief which can be obtained, must result from the party abstaining from the use of those articles of diet, and substituting some other in their place. A most important question in state medicine arises from a review of this subject: viz., whether the introduction of tea and coffee into general use is to be regarded as beneficial to the community, or otherwise? In many parts of France and Italy, tea is classed by the excise in the list of drugs—is kept in bottles on the shelves of the apothecary, forms no part of the stock of the grocer, and is even anathematized by the lecturer on *hygiène*, as unfited for ordinary consumption. It is, therefore, placed, by common consent, in the custody of the physician, to be dealt with as a remedial agent, *secundem artem*. Whether they manage these things best in France or in England, remains to be seen. Mr. Cole thinks it probable that the great increase which has taken place in diseases of the heart in this country, may be referred to the abuse of this beverage. He considers green tea to be productive of more uneasiness and excitement than black, and regards coffee as ranking next in this respect. With regard to *spurious* tea, Professor Burnett has proved that the practice is very common of adding the leaves of the sloe, the apple, the hawthorn, and the elm, to the Chinese leaf. This spurious addition resembles the real tea so exactly, that the most experienced examiners at the India House were at fault in detecting the adulteration; even chemical analysis failed to expose the fraud, inasmuch as the constituents of the British leaves were similar to those of the genuine herb imported from the Celestial Empire. The botanist alone succeeded in detecting the sophistication, and this he effected by his knowledge of the distinctive characters of each particular leaf. In order to impose upon the public, the spurious leaves are placed upon plates of heated iron and carefully rolled, so as to correspond with the genuine tea. It is then mixed with it, in the proportion of one part to three, and put into circulation. Professor Burnett drank some of this tea, which affected him with slight nausea. He thought the flavour mawkish and disagreeable, in comparison with that of the real tea.

Candles.—There is a very simple and efficient means for making candles. It consists of an upright beam, about five feet high, with two cross arms, six and a half feet long, to the ends of which eight heads of candles are suspended, and, by an ingenious contrivance, these are dipped without the clumsy and inconvenient mode of the cross arms being made to descend. Its size is less than half the common dipping mould, while double the quantity can, at one time, be manufactured by it, and the whole can be made for 10*s.* or 12*s.* The inventer is Mr. John Rankine, of Falkirk, grandson to Mr. Symington, of steam-boat celebrity.—*Stirling Journal.*

To make Copal Varnish for fine Paintings, &c.—Fuse 8 lbs. of the very cleanest pale African gum copal, and, when completely run fluid, pour in two gallons of hot oil, old measure; let it boil until it will string very strong: and in about fifteen minutes, or while it is yet very hot, pour in three gallons of turpentine, old measure, and got from the top of a cistern. Perhaps, during the mixture, a considerable quantity of the turpentine will escape, but the varnish will be so much the brighter, transparent, and fluid; and will work freer, dry quickly, and be very solid and durable when dry. After the varnish has been strained, if it be found too thick, before it is quite cold, heat as much turpentine and mix with it as will bring it to a proper consistence.—Mr. J. W. Neil, in *Repertory*, No. 5.

Sydney Sand.—An exhaustless magazine of purely siliceous sand constitutes the great bulk of the soil of Sydney. A member of the committee of the School of Arts has lately ascertained the unrivalled excellence of this sand in the manufacture of glass. Specimens of this glass, made wholly of Sydney sand, which had been sent to Great Britain for the express purpose of experiment, have been pronounced superior to that which the best home materials have enabled the British manufacturers to make. The glass in question is pronounced to be especially fitted for the formation of lenses: and this, at a time when accurate observation of optical phenomena occupies a prominent and singularly interesting portion of philosophical investigation.—*Mirror*, No. 675.

Shagreen can hardly be called leather, for it is in the state of skin, and is used, or rather was used, for covers of watch-cases and other similar purposes. Astrakan is the seat of this manufacture. The material is the strong skin that covers the crupper of the ass or the horse. The skin is first soaked in water for some days till the hair is loose enough to be scraped off; after which it is cut and scraped till it becomes scarcely thicker than a hog's bladder. It is then, while wet and soft, fastened to a frame, the flesh side undermost, and the upper or grain side is strewed over with the hard round seeds of a species of chenopodium; a felt is then laid over it, and the seeds are trodden deeply into the soft yielding skin. The frames are then placed in the shade till the skin becomes dry and the seeds will shake out of their holes. Next, the skin is rasped till the sides of the holes are worn down almost to a level with their bottoms: it is then soaked, first in water, and afterwards in an alkaline lie; and, as it becomes soft, those parts of the skin which were merely depressed by the seeds being forced down upon them, rise above the parts which had been rasped, presenting a granular pustular surface. The skin is then stained superficially of a green colour by copper filings and sal ammoniac, and is afterwards allowed to dry: lastly, the grains or warts are rubbed down to a level with the rest of the surface, which thus presents the appearance of white dots on a green ground;

and when polished is very beautiful as well as durable.—Mr. A. Aikin, in *Trans. Society of Arts*, 1834, vol. 1, pt. 1.

German Razor-hone.—This is universally known throughout Europe, and generally esteemed as the best whet-stone for all kinds of the finer description of cutlery. It is obtained from the slate mountains in the neighbourhood of Ratisbon, where it occurs in the form of a yellow vein running virtually into the blue slate, sometimes not more than an inch in thickness, and varying to twelve and sometimes eighteen inches, from whence it is quarried, and then sawed into thin slabs, which are usually cemented into a similar slab of the slate, to serve as a support, and in that state sold for use. That which is obtained from the lowest part of the vein is esteemed the best, and termed old rock.—Mr. R. Knight, in *Trans. Society of Arts*, 1834, vol. i., pl. 1.

Strengthening Thread Network, Cordage and coarse Cloth.—The lixivium of oak bark has been employed for scarcely any other purpose than that of the tanner, and yet it is applicable to a great variety of uses. If thread, cords, nets, coarse linen, &c. be steeped in it, they acquire greater firmness and durability. Fishermen have long resorted to this. Nothing is more apt to spoil than skins, and yet this preserves them. It is the same with hempen and linen cloth. They contain much gummy and resinous matter, which with tannin, forms an envelope, and thus adds to their durability. Linen ought not to steep more than eight or ten days in this solution: it acquires a very brown colour. When this colour fades, the operation may be repeated. The best method of preserving nets and cordage is the following;—dissolve two pounds of Flemish glue in fifteen gallons of water, dip the nets, &c. into this solution, and then steep them in a strong solution of oak or chestnut bark,—the tannin combines with the gelatin, and forms, between the fibres of the hemp, a solid net work which adds great strength to the cords. Any bark which contains tannin may be employed in making a decoction; so bones, parings of skin, remains of fish, &c., and generally all substances containing gelatine may be used in making a gelatinous solution. Fishermen, who often throw away on the shore gelatinous fish, may use them for this purpose. —*Journal des Connaissances Usuelles.*

A Tried Recipe for Burns—Keep on hand a saturated solution of alum (four ounces in a quart of hot water) dip a cotton cloth in this solution, and lay it immediately on the burn. As soon as it shall have become hot or dry, replace it by another, and thus continue the compress as often as it dries, which it will, at first, do very rapidly. The pain immediately ceases, and in twenty-four hours, under this treatment, the wound will be healed, especially if the solution be applied before the blisters are formed. The astringent and drying quality of the alum completely prevent them.

The deepest burns, those caused by boiling water, drops of melted metal, phosphorous, gunpowder, fulminating powder, &c. have all been cured by this specific.—*Idem.*

To remove a Hard Coating or Crust from Glass and Porcelain Vessels.—It often happens that glass vessels, used as pots for flowers and other purposes, receive an unsightly deposit or crust, hard to be removed by scouring or rubbing.—The best method to take it off, is to wash it with a little dilute muriatic acid. This acts upon it, and loosens it very speedily.—*Idem.*

Scotch Method of Preserving Eggs.—Dip them, during one or two minutes in boiling water. The white of the egg then forms a kind of membrane, which envelopes the interior, and defends it from the air. This method is preferable to the varnish proposed by Reaumur.

Substitute for India Ink.—Boil in water, some parchment or pieces of fine gloves, until it is reduced to a paste. Apply to its surface while still warm, a porcelain dish which has been held over a smoking lamp: the lamp black which adheres to it, will become detached and mingle with the paste or glue. Repeat the operation until the composition has acquired the requisite colour. It is not necessary to grind it. It flows as freely from the pencil as India ink, and has the same transparency.

India Rubber Carpets—Having some India rubber varnish left, which was prepared for another purpose, the thought occurred to the writer, of trying it as a covering to a carpet, after the following manner:—A piece of canvass was stretched and covered with a thin coat of glue, (corn meal size will probably answer best,) over this was laid a sheet or two of common brown paper, or news paper, and another coat of glue added, over which was laid a pattern of house papering, with rich figures. After the body of the carpet was thus prepared, a very thin touch of glue was carried over the face of the paper to prevent the India rubber varnish from tarnishing the beautiful colours of the paper. After this was dried, one or two coats, (as may be desired,) of India rubber varnish were applied, which, when dried, formed a surface as smooth as polished glass, through which the variegated colours of the paper appeared with undiminished, if not with increased lustre. This carpet is quite durable, and is impenetrable to water, or grease of any description. When soiled, it may be washed, like a smooth piece of marble, or wood. If gold or silver leaf forms the last coat, instead of papering, and the varnish is then applied, nothing can exceed the splendid richness of the carpet, which gives the floor the appearance of being burnished with gold, or silver.

Materials for Paper.—By a series of experiments, it has been ascertained that paper, of an excellent quality, can be prepared, not only from the husks of Indian corn, but also from a pulp made from various kinds of wood and bark, particularly from the bark of several kinds of poplar, and from the wood of birch, and some other trees.—In conducting experiments, the plan has been, first to select the vegetable matter, then, if it required whitening, to bleach it in chlorine gas, and afterwards to reduce it to a fine pulp, by pounding, and filing in water. When properly prepared, a small portion of the pulp is to be placed between polished steel plates, slightly warmed, and strongly compress them by screw power; the degree of consistency and polish, assumed by the pulp, under such compression, would indicate the quality of paper capable of being prepared from the vegetable matter used. The writer trusts that the time will soon arrive, when rags, will not be considered as indispensable in the manufacture of paper, and will be, when economy or convenience requires it, superseded by different kinds of vegetable substances, which are so cheaply, bountifully and universally furnished by nature.

Bread from Wood—Dr. Prout has clearly proved that all the chief alimentary matters employed by man may be reduced to three classes:—viz. saccharine, oily, and albuminous substances, the most perfect specimens of which are respectively sugar, butter, and white of egg. The saccharine principle, in its extended sense, includes all those sub-

stances which are chiefly derived from the vegetable kingdom; means in fact, the same thing as what we commonly call vegetable diet. It comprehends all those substances, whatever their sensible properties may be, into the composition of which hydrogen and oxygen enter in the proportion in which they form water; for example, the fibre of wood, which chemists call *lignin*. Much skilful manipulation and delicacy of experiment were required to establish this result; but the nutritive property of the woody fibre—in short, that a tolerably good quartern loaf can be made out of a deal-board—has been proved by the recent labours of a German professor, and may be verified by any one who will take the trouble to repeat them. The following, says Dr. Prout, was the method he employed for this purpose:—In the first place, every thing that was soluble in water was removed by maceration and boiling; the wood was then reduced to a minute state of division, not merely into fine fibres, but actual powder, and after being repeatedly subjected to the heat of an oven, was ground in the usual manner of corn. Wood thus prepared, according to the author, acquires the smell and taste of corn flour. It is, however, never quite white, but always of a yellowish colour. It also agrees with corn flour in this respect, that it does not ferment without the addition of leaven, and in this case sour leaven of corn flour is found to answer best. With this it makes a perfectly uniform and spongy bread; and when it is thoroughly baked, and has much crust, it has a much better taste than what, in times of scarcity, is prepared from bran and husks of corn. Wood flour also, boiled in water, forms a thick, tough, trembling jelly, like that of wheat starch, and which is very nutritious. The nutritious properties were first tried on a young dog; afterwards he fed two pigs upon it; and then, taking courage from the success of the experiment, the professor attacked it himself. His family party, he says, ate it in the form of gruels or soup, dumplings, and pancakes, all made with as little of any other ingredient as possible; and they found them palatable and quite wholesome.—*Quarterly Review.*

New Substance for Dyeing.—The *Memorial Bordelais* states, that a vessel has arrived at Bordeaux laden with 145 cases of new substances for dyeing, imported from India by order of the Minister of Commerce. These substances, which it says are entirely unknown in the French manufactories, are used for dyeing linen, cotton, silk, wool, &c., at Pegu, Java, &c., and other Indian possessions. They were first discovered by a chemist named Gonfreville, who made a voyage to the East Indies under the especial auspices of the Minister of Marine. A number of specimens, dyed with these new materials, have been sent to the Exhibition of the products of National Industry.

MISCELLANIES.

LIST OF PATENTS SEALED IN 1834.

Corn-Mill.—T. Sharp, and R. Roberts, of Manchester, engineers, for improvements in machinery for grinding corn, &c.—Jan. 1.

Lamp.—J. T. Beale, of No. 11, Church-lane, Whitechapel, engi-

neer, for a lamp to burn substances not hitherto usually burnt in such vessels or apparatus.—Jan 4.

Cutting Fur.—F. Plant, of Bread-street-hill, London, for an improved fur cutting machine —Jan. 13.

Carriage Wheels.—P. Tigar, of Grovehill, York, merchant, for iron and other metal wheels for carriages.—Jan. 13.

Condensing.—J. Bates, of Bishopsgate-street, London, merchant, for an improved method of condensing aeriform substances, and refrigerating fluids.—Jan. 13.

Cloth Dressing.—J. Walton, of Sowerby Bridge, York, cloth dresser, for improvements in machinery for raising, dressing, and cropping the pile of woollen fabrics.—Jan 14.

Pigment.—C. Attwood, of Wickham, near Gateshead, Durham, manufacturer of soda, for the art of making a certain pigment or certain pigments, not previously used for such purpose or purposes.—Jan. 16.

Instantaneous Light,—J. Boynton, of High Holborn, portable inkstand manufacturer, for improvements in apparatus or means of producing light.—Jan. 18.

Heating.—W. Morgan, of Penton-row, Walworth, Surrey, plumber and glazier, for an apparatus for heating and ventilating churches, conservatories, &c.—Jan. 18.

Boilers—J. J. L. Oberlin, of Leicester-square, merchant, for improvements in boilers.—Jan. 18.

Fire-Places.—E. Wolff, of Stamford-hill, Middlesex, gentleman, for improved means of supplying heated air, to support combustion in enclosed fire-places.—Jan. 23.

Boilers.—W. T. Yates of John-street, Cambridge-heath, Middlesex, engineer, for improvements in boilers.—Jan. 23.

Manufacturing Salt.—W. Garrod, of Davenham, Chester, gentleman, for improvements in manufacturing salt.—Jan 25.

Pens and Pen-holders.—N. Arnot, of Bedford-square, Esq., for improvements on metallic pens, and on pen-holders.—Jan. 25.

Steam-Carriages.—B. Hick, of Bolton-le-Moors, Lancaster, engineer, for improvements in locomotive steam-carriages, ordinary carriages, and steam-engines.—Jan. 25.

Hot-Pressing.—J. F. V. Gerard, of Redmond's-row, Mile-end, for improvements in finishing silks, woollen cloths, stuffs, and other substances, requiring heat and pressure.—Feb. 8.

Guns.—W. S. Gillett, of Guilford-street, for improvements in gun and other small arms.—Feb. 28.

Lamps.—G. A. Miller, of No. 179, Piccadilly, wax chandler, for an improvement in lamps.—Feb. 8.

Cotton Roving.—B. Dobson, of Bolton-le-Moors, mechanist, and J. Sutcliff and R. Threlfall, both of the same place, mechanists, for improvements in machinery for roving and spinning cotton &c.—Feb. 8.

Fire-Proof.—W. Marr, of No. 33, Bread-street, London, ironmonger, for an improved method of manufacturing all kinds of copper, iron, tin, and other metal safes, and boxes, and repositories, fireproof.—Feb. 13.

Steam-Engines.—S. Hall, of Basford, cotton manufacturer, for improvements in steam-engines—Feb. 13.

Metal Vessels.—T. Griffiths, of Birmingham, tin-plate worker, for an improvement in tea-kettles, &c.—Feb. 15.

Metal Bolts.—M. Berry, of 66, Chancery-lane, engineer, for improvements in machinery for forming metal bolts, rivets, nails, &c.—Feb. 19.

Wool Combing.—J. Noble, of Halifax, worsted spinner, for improvements in the combing of wool.—Feb. 20.

Spinning.—J. Smith, of Deanstone Works, Perthshire, cotton-spinner, for improvements in spinning-machinery.—Feb. 20.

Woollen Cloth.—G. Haden, of Trowbridge, engineer, for improvements in the machinery for manufacturing woollen cloth.—Feb. 24.

Leaf-turning Machine.—J. Ramsay, of Caroline-place, Macklenburgh-square, Esq., for improvements in apparatus for turning over the leaves of music and other books.—Feb. 26.

Hydraulic Engine.—V. Motte, of Bridge-street, Blackfriars, Esq., for an improved hydraulic power engine.—Feb. 27.

Carding.—J. Smith, of Deanston Works, Perthshire, for improvements in machinery for carding cotton, flax, wool, silk.—Feb. 27.

Pen-holders.—J. D. Harding, of Gordon-square, Middlesex, for improvements on pencil, pen, and chalk cases or holders.—Feb 27.

Screw-cutting.—J. Whitworth, of Manchester, mechanist, for improvements in machinery or apparatus for cutting screws.—Feb. 27.

Weighing Machines.—R. H. Goddard, of Woolwich, gent., for improvements in weighing machines, and in registering work performed by weighing, measuring, or numbering apparatus.—Feb. 27.

Nail-Making.—T. J. Fuller, of the Commercial-road, Middlesex, civil engineer, for improvement in machinery for making or manufacturing of nails.—Feb. 27.

Sugar Manufacture.—W. A. Archbald, Lieut. R. N. for improvement in making sugar.—Feb. 27.

Propelling.—H. Linkins, of North Crescent, Bedford-square, gent., for an improved method of propelling carriages on railways or common roads, and vessels on canals.—March 1.

Nail-Making.—T. J. Fuller, of the Commercial-road, Middlesex, civil engineer, for an improvement in nails, spikes, and bolts.—March 6.

Steam-Engines.—W. Morgan of the Kent-road, Surrey, Esq., for improvements in certain kinds of steam-engines.—March 13.

Guns.—J. A. Manton, the small Gun-office, Tower of London, gun-maker, for improvement in fire-arms.—March 13.

Galvanism.—J. I. Hawkins, of Pancras Vale, Middlesex, civil, engineer, for improved instruments for facilitating the cure of disease by administering galvanic influence into the human body.—March 13.

Rivets and Bolts.—J. J. Cordes, of Idol-lane, London, merchant, for improvement in machinery for making rivets and screw blanks or bolts.—March 18.

Nail-Making. J. J. Cordes, of Idol-lane, London, merchant, for improvement in machinery for making nails.—March 18.

Nail-Making.—S. Slocum, of the New-road, St. Pancras, engineer, for improvements in machinery for making nails.— March 18.

Pin-Making.—S. Slocum, of the New-road, St. Pancras, engineer, for improvements in machinery for making pins.—March 18.

Looms.—J. P. Reid, and T. Johnston, of Glasgow, for improvements applicable to certain looms—March 20.

Iron Hoops.—H. Crane, merchant, and J. Young, of Wolverhampton, patent lock manufacturer, for improvements in the making of iron hoops. —March 20.

Chronometers.—T. Baker, of 19, Upper Stamford-street, Surrey, gent., for improvements in chronometers, watches, and cloaks.—March 20.

Navigation Instruments.—J. Taylor, of East-street, Red Lion-square, Middlesex, for improvements in instruments for measuring angles and distances, applicable to nautical and other purposes.—March 27.

Embroidered Lace.—H. W. Nunn, of Whippingham, in the Isle of Wight, bobbin-net lace manufacturer, for improvements in manufacturing certain kinds of embroidered lace.—March 27.

Carding.—J. Walton, of Sowerby-bridge, York, cloth-dresser, for improvements in cards for carding wool, cotton, silk, and for raising the pile.—March 27.

Motive Power.—J. C. Douglas, of Great Ormond-street, Esq., for apparatus from which a motive principle of power is obtained; likewise for increasing said motive principle, applicable to various denominations of locomotion, and to stationary machinery; and for raising solid and fluid bodies, constructing apparatus and vehicles to be propelled or worked by means of the said power.—March 29.

Cloth Dressing.—W. Hirst, of Leeds, clothier, for improvements in machinery for dressing and finishing woollen and other fabrics.—March 31.

Engraving on Cylinders.—H. Deverill, of Manchester, Gent., for a method of engraving and etching on cylindrical surfaces, for printing and other purposes.—March 31.

Locomotive Carriages.—G. Millichap, of Birmingham, carriage axle-tree manufacturer, for certain improvements on locomotive carriages.—March 31.

Yellow Dye.—H. Hendriks, of the Strand, Gent., for improvements in dyeing woollen yellow.—April 8.

Evaporating.—H. Crosley, of Hooper-square, Leman-street, London, engineer, for an improved process of evaporation.—April 8.

Pumps.—A. V. J. D. Asda, of Adam-street, Adelphi, Gent., for improvements on pumps.—April 10.

Stretching Machine.—S. Morand, of Manchester, merchant, for improvements on his improved stretching machine.—April 12.

Supplying Water—J. Beare, of Pall-mall East, civil engineer, for improvements in engines for raising or conveying water.—April 12.

Sheathing.—W. Williams, of Pembrey-house, near Llanelly, and T. Hay, of Kidwelly tin-works, Carmarthen, Gents., for improvements in preparing metals for sheathing the bottoms of ships.—April 17.

Cement.—J. H. Cassell, of Mill-wall, Poplar, merchant, for a cement for the purposes of stone or brick.—April 19.

Substitute for Soap.—J. Hewitt, of Kenegie, Cornwall, Gent., for a substitute for soap.—April 19.

Side Saddles.—J. J. Segundo, of Burton-crescent, Esq., for an apparatus applicable to the security of side saddles.—April 22.

Distillation.—J. Shee, of Lawrence Pountney-place, London, Gent., for improvements in distillation.—April 22.

Screws, Bolts, &c.—J. Bethell, of Mecklenburgh-square, Gent., for improvements in machinery or apparatus for making metal screws, pins, bolts, and rivets.—April 24.

Steam Engines.—E. Wolf, of Stamford-hill, Middlesex, merchant, for an improvement in steam engines.—April 26.

Anchors.—J. Christophers, of New Broad-street, London, merchant, for an improvement on anchors.—April 26.

Steam Engines.—W. Gittins, of St. Pancras, Esq., for an improved mode of applying the water used for condensation in marine and other steam engines to the condenser.—May 6.

Pumps.—W. A. Noble, of Cross-street, Cherry Garden-street, Bermondsey, Surrey, engineer, for improvements in pumps, engines, machines, or apparatus for drawing, raising, forcing, or propelling water.—May 6.

Cutting Wood.—A. B. Shankland, of Egremont-place, St. Pancras, Gent., for a machine or engine for cutting wood into certain shapes or forms.—May 6.

Hydraulics.—L. Brunier, of Vineyard-walk, Clerkenwell, architect and civil engineer, for an hydraulic machine (of a centrifugal force) for raising or forcing water.—May 8.

Steam Engines.—J. M'Dowall, of Johnstone, near Paisley, Renfrew, Scotland, mechanist and engineer, for improvements on metallic pistons, pump buckets, and boiler steam engines.—May 12.

Dressing Cloths.—J. Dutton, of Wotton-under-Edge, Gloucester, clothier, for an improvement in dressing woollen cloths.—May 12.

Weighing Machine.—G. Bather, of the Haymarket, scale-maker, for a weighing machine upon a new construction.—May 22.

Water-proof Leather.—T. Edmonds, of Burton-street, Hanover-square, for a certain process of manipulation and treatment for the preparation of leather less pervious to water than prepared by the ordinary means.—May 22.

Candles.—J. Morgan, of Manchester, pewterer, for improvements in the apparatus used in the manufacture of mould-candles.—May 22.

Fire-Arms.—C. L. S. B. Heurteloup, of Holles-street, Cavendish-square, for improvements in fire-arms.—May 22.

Preparing Hemp.—A. Smith, of Princes-street, Leicester-square, mechanist and engineer, for a new and improved method of preparing phormium tenax, hemp, flax, &c.—May 24.

Weaving.—L. Smith, of Manchester, cotton-manufacturer, and J. Smith, of Hepwood, machine-maker, for improvements in weaving machinery.—May 24.

Motive Power.—P. A. De Chapeaurouge, of Fenchurch-street, London, for apparatus for producing motive power, and called in France, by the inventer, "voland-moteur perpetuel."—May 24.

Warming-Pans.—S. Hawkins, of Milton-house, near Portsmouth, for improvements in warming-pans.—May 24.

Steam Engines.—J. G. Bodmer, of Bolton-le-Moors, civil-engineer, for improvements in steam engines and boilers.—May 24.

Stoves and Furnaces.—J. G. Bodmer, of Bolton-le-Moors, civil-engineer, for improvements in grates, stoves, and furnaces, applicable to steam engines, &c.—May 24.

Bobbin-net.—W. Crofts, of New Radford, Nottingham, for improvements in machinery for making bobbin-net.—May 27.

Power-Looms.—W. H. Hornby, of Blackheath, Lancaster, cotton-spinner and merchant, and W. Kenworthy, of Blackburn, aforesaid, engineer, for improvements in power-looms.—May 27.

Roving and Slubbing.—R. Simpson, of Southampton-row, Bloomsbury, for improvements in machinery for roving and slubbing cotton and wool.—June 3.

Bobbin-net.—J. Bertie, of Basford, Nottingham, mechanist, and J. Gibbons, of Radford, mechanist, for improved texture of bobbin-net or twist-net.—June 5.

Saddles.—G. S. L. Greenfell, of Paris, merchant, Cadogan-place, Sloane-street, for improvements in saddles.—June 5.

Fermenting.—E. Keele, of Titchfield, Southampton, brewer, for an improved apparatus for close fermenting and cleansing saccharine and fermentable fluids.—June 7.

Drying.—T. R. Bridson, of Great Bolton, Bolton-le-Moors, bleacher, for improvements in apparatus in drying cotton, linen, &c.—June 10.

Carding.—J. Whitaker, of Wardle, near Rochdale, Lancaster, flannel-manufacturer, for improvements in engines for carding wool.—June 12.

Drying and Printing.—M. Bash, of Dalmarnoch Printfield, near Bonhill, by Dunbarton, North Britain, calico-printer, for improvements in apparatus for drying and printing calicoes.—June 14.

Surgery.—J. L. Hannah, of Brighton, M.D., for improvements in surgical instruments for reducing the stone in the bladder, and enabling the patient to pass it off through the urethra.—June 16.

Weaving.—J. Jones, cotton-manufacturer, and T. Melledew, of Oldham, Lancaster, mechanist, for improvements in power-looms, and in the manufacture of corded fustian or fabric, woven in diagonal cords.—June 16.

Spinning.—C. Wilson, of Kelso, Roxburgh, for improvements in machinery in the preparation for spinning wool.—June 17.

Boot Machine.—I. Jecks, jun., of Bennett's-hill, London, for an apparatus for drawing on or off boots.—June 17.

Paddle-Wheel.—W. Symington, of Bromley, cooper, and A. Symington, of Falkland, Fifeshire, watch-maker, for a paddle-wheel of a new and useful construction.—June 23.

Cleaning Rice, &c.—J. C. Lyman, of Golden-square, for improvements in hulling and cleansing rice, barley, and coffee.—June 24.

Fire-Arms.—R. Walker, of Birmingham, manufacturer, for an improvement in wadding for fire-arms.—June 26.

Life-Preserver.—J. Bateman, of Islington, cooper, for an apparatus for saving human life, in case of shipwreck.—June 30.

Pumps.—J. Barton, of Providence-row, Finsbury, engineer, and S. and J. Nye, of St. Andrew's-row, Southwark, mechanics, for improvements in pumps.—July 1.

Slate-Cutting.—T. Barton, clerk, of Whitby Bush, Rudbuxton, Pembroke, for improvements in machinery for cutting slates.—July 3.

Axletrees.—J. Hardy, of Wednesbury, Staffordshire, for improvements in axletrees for carriages.—July 3.

Piston Packings.—B. Hick, of Bolton-le-Moors, engineer; E. Evans, the elder, of Oldham, coal proprietor; and J. Higgins, of Oldham, engineer, for improvements in metallic packings for the pistons of steam and other engines, pumps, &c.—July 4.

Machinery.—W. Higgins, of Salford, for improvements in machinery for making twisted rovings and yarn of cotton, flax, silk, wool, &c.—July 7.

Glass-Making.—J. Gold, of Birmingham, glass-cutter, for improvements in cutting and preparing glass decanters.—July 7.

Button-Making.—J. Aston, of Birmingham, button-maker, for an improvement in the manufacture of buttons.—July 10.

Nautical Machine.—G. Beadon, of Taunton, Lieut. R. N., for an apparatus for preventing boats from capsizing or overturning when oppressed by too much sail, and for easing off the ropes and sheets of vessels.—July 10.

Tobacco Machine.—L. W. Wright, of Sloane-terrace, Chelsea, engineer, for improvements in machinery for cutting tobacco.—July 10.

Power Looms.—J. Ramsbottom, mechanist, and R. Holt, of Todmorton, iron-founder, for improvements in the construction of power-looms.—July 12.

Spinning.—P. Wright, of Edinburgh, manufacturer, for an improved method of spinning, twisting, and twining cotton, flax, silk, wool, &c.—July 17.

Bleaching Oils.—W. S. Losh, of Walker, Northumberland, gent., for an improved method of bleaching animal fats, and animal, vegetable, and fish oils.—July 17.

Beer Engine.—J. Warne, of Union-street, Southwark, pewterer, for improvements in engines for raising, drawing, or forcing beer, ale, &c.—July 17.

Inland Navigation.—J. Twisden, of Halberton, near Tiverton, R. N., for improvements in inland navigation.—July 24.

Windmills.—W. Hale, of Colchester, civil engineer, for improvements in windmills.—July 26.

Medicine.—W. Coles, of Charing Cross, Esq., for a certain remedy for the cure, alleviation, or prevention of rheumatic, gouty, or other affections arising from colds or other causes.—July 26.

Weighing Machine.—P. B. G. Debac, of Acre-lane, Brixton, for an improved machine for weighing and registering.—July 26.

Cooling.—J. Chanter, of Stamford-street, Blackfriars, gent., and W. Witty, of Basford-cottage, near Newcastle, Staffordshire, engineer, for an improved method of abstracting heat from steam, and other vapours, and fluids.—July 26.

Propelling.—T. J. Hamilton, Earl of Orkney, and J. Easter, engineer, both of Taplow, Bucks, for improvements in machinery for propelling vessels and water.—July 26.

Smokey Chimneys.—E. Youldon, of Exmouth, for improvements in preventing or curing smokey chimneys.—August 5.

Cooling.—L. W. Wright, of Sloane-terrace, Chelsea, engineer, for improvements in apparatus for refrigerating fluids.—August 9.

Pottery.—T. Gaunt, of Bridport-place, Hoxton, gent., for an improvement in earthenware pans or basins of water-closets, and other earthenware vessels.—August 12.

Looms.—A. Hall, of Manchester, manufacturer, and J. Stark, the younger, of Chortten-upon-Medloch, for improvements in looms for weaving by hand or power.—August 12.

Ventilation.—J. Ward, of Stratford-upon-Avon, watch-maker, for improvements in apparatus for ventilating buildings.—August 12.

Cocks.—C. Arter, of Havant, Southampton, plumber and glazier, for improvements on cocks and taps.—August 12.

Bobbin-Net.—J. Pedder, of New Radford, mechanist, for improvements in machinery for making ornamented bobbin-net.—August 13.

Biscuit Machinery.—W. Bruce, of Edinburgh, baker, for improvements in machinery for making ship and other biscuit or bread.—August 14.

Cooling.—J. Perkins, of Fleet-street, London, engineer, for improvements in apparatus for producing ice, and in cooling fluids.—August 14.

Paper-Hanging.—T. de la Rue, of Finsbury-place, Middlesex, for improvements in manufacturing embossed paper-hangings.—August 15.

Cork-Cutting.—J. K. N. Thomson, of Holland-street, Blackfriars, cork manufacturer, for improvements in machinery for cutting or making corks and bungs.—August 23.

Steering Vessels.—J. Rapson, of Penryn, engineer, for an improved apparatus for facilitating the steering of vessels.—August 23.

Steam Engines.—R. Stem, of Walcot-place, Lambeth, Esq., for improvements in engines to be worked by steam.—August 23.

Hydraulics.—G. Child, of Brixton, gent., for improvements in machinery for raising water.—August 23.

Rosin Manufacture.—W. Flockton, of Horsleydown, Southwark, turpentine distiller, for an improvement in manufacturing rosin.—Aug. 23.

Bleaching.—J. Slater, of Salford, bleacher, for improvements in improved machinery for bleaching linen and cotton goods.—August 23.

Dressing Cloth.—J. Beard, of Leonard Stanley, Gloucester, for improvements in machinery for dressing woollen cloth.—September 1.

Glass Manufacture.—G. J. Green, J. O. Bacchus, and W. Gammon, of Birmingham, glass manufacturers, for improvements in the manufacture and working of plate, and other glass.—September 1.

Furnaces.—J. Chanter of Stamford-street, Surrey, and of Earl-street, Blackfriars, London, gent., for an improvement in furnaces.—Sept. 2.

Fermentation.—J. J. C. Sheridan, of Walworth, chemist, for improvements in the several processes of saccharine, vinous, and acetous fermentation.—September 6.

Lock.—W. Longfield, of Otley, York, whitesmith, for an improved lock.—September 6.

Fire-Arms.—H. Shrapnel, of Salisbury, Major-Gen. and Col. in the Royal Artillery, for improvements in fire-arms and ammunition. —September 6.

Corn Mills.—M. Berry, of 66, Chancery-lane, civil engineer, for improvements in mills for grinding wheat and other grain.—September 13.

Pens and Pen-holders.—S. Perry, of Wilmington-street, gent., and E. Massey, senior, of King-street, Clerkenwell, watch-manufacturer, and P. J. Gauci, of North-crescent, Bedford-square, artist, all in Middlesex, for improvements in pens and pen-holders.—September 20.

Cooking Apparatus.—E. Weeks, of King's-road, Chelsea, horticultural builder, for improvements on kitchen or other grates or ranges, which he denominates Weeks's Cooking Apparatus.—September 20.

Carriages.—C. Tongue, of Gatacre-park, Salop, Esq., for improvements in apparatus for preventing accidents to travelling carriages.—September 25.

Gas-Lighting.—J. B. Mollerat, Whiteheads-grove, Chelsea, manufacturing chemist, for improvements in the manufacture of gas for illumination.—September 25.

Furnaces and Stoves.—R. Witty, of Hanley, Staffordshire, civil engineer, for improvements in saving fuel and burning smoke in furnaces and stoves.—September 25.

Bobbin-Net.—S. Draper, of Radford, Nottinghamshire, lace-maker, for an improved manufacture of bobbin-net .—September 25.

Cutting Turnips.—J. Gardner, of Banbury, Oxfordshire, ironmonger, for improvements on machines for cutting turnips, mangel-wurzel, &c.—September 25.

Woollen Cloth.—J. C. Daniell, of Tiverton-mills, near Bath, clothier, for improvements in manufacturing woollen cloth.—September 25.

Artificial Stone.—R. F. Martin, of Hercules-buildings, Lambeth, gent., for processes of combining various materials, so as to form stuccoes, plasters, or cements, and for the manufacture of artificial stones, marbles, &c.—October 8.

Nail Machinery.—J. J. Cordes, of Idol-lane, London, merchant, for improvements in machinery for making nails.—October 8.

Rivets and Screw Bolts.—J. J. Cordes, of Idol-lane, London, merchant, for improvements in machinery for making rivets and screw bolts.—October 8.

Steam Carriages.—B. Hick, of Bolton-le-moors, Lancashire, engineer, for improvements in locomotive steam-carriages.—October 8.

Spinning.—T. Sharp, and R. Roberts, of Manchester, engineers, for improvements in machinery for spinning and doubling cotton, silk, flax, &c.—October 8.

Propelling Vessels.—J. Ericsson, of Union-wharf, Albany-street, Regent's-park, engineer, for improved machinery applicable for propelling vessels.—October 10.

Spectacles.—G. R. Elkington, of Birmingham, optician, for improvements in the manufacturing spectacles.—October 10.

Steam-Boilers.—T. Searle, of Coleman-street, London, merchant, for improvements in steam-boilers.—October 11.

Lock-Protector.—*Lord Baron* Audley, (thus styled in the patent), of Raleigh Castle, Stafford, for an apparatus which he denominates a lock-protector.—October 11.

Steam-Engines.—S. Seward, of All Saints, Poplar, engineer, for improvements in the construction of steam-engines.—October 17.

Looms.—C. M. H. Molinard, of Brewer-street, Golden-square, merchant, for improvement in looms.—October 17.

Watches and Clocks.—G. Littlewort, of Rahere-street, Goswell-road, Middlesex, watch and clock-maker, for improvements on watches and clocks.—October 17.

Slubbing, Roving, &c.—M. M'Gregor, of Manchester, manufacturer, for improvements in machinery for slubbing, roving, twisting, and doubling cotton.—October 20.

Rovings.—J. Jones, of Salford, Manchester, machine-maker, for improvements for making rovings, spinning and doubling of cotton, silk, flax, &c.—October 20.

Saddles.—M. Bower, manufacturer, and G. Blyth, of Birmingham, merchant, for improvements on, or additions to, saddles.—October 22.

Bricks.—J. B. Pleney, of Panton-square, Middlesex, brickmaker, for improved machinery for manufacturing articles out of brick and other earth.—October 22.

Glass Manufacture.—J. and J. Hartley, of West Bromwich, near Birmingham, glass-manufacturers, for improvement or certain improvements in the manufacture of glass.—October 22.

Grates.—J. Stanley, and J. Walmsley, both of Manchester, mechanists, for improvements on grates, or apparatus applicable to steam-engines or other purposes, and in apparatus for feeding the same with fuel.—October 22.

Looms.—A. Stone, of Johnstone, in the county of Providence, and State of Rhode Island, in the United States of America, mechanist, now residing at Liverpool, for an improvement on power and other looms.—Oct. 22.

Hats.—G. D. Carey, of Basford, Nottingham, hat-manufacturer, for machinery to be employed in the manufacture of hats.—October 23.

Engine-Pumps.—J. Hearle, of Devonport, engineer, for improvements on engine-pumps.—Nov. 3.

Carriages.—J. Gibbs, of Kennington, engineer, for improvements in carriages and in wheels for carriages.—Nov. 3.

Filter.—S. Bagshaw, St. James's, Middlesex, for an improved filter.—Nov. 6.

Pumps and Presses.—P. R. Jackson, of Bolton-le-Moors, Lancaster, engineer, for improvements in hydraulic presses and pumps.—Nov. 6.

Dressing Clothes.—J. Walton, of Sowerby Bridge, York, cloth-dresser and finisher, for improvements in the machinery used for raising the pile of woollen and other cloths.—Nov. 12.

Preserving Meat.—D. R. Long, of Bath, chemist, for a new mode of applying certain antiputrescent and flavouring substances to meat.—Nov. 13.

Steam-Engine.—J. M. Cramer, of Leicester-square, mechanist, for an improved steam-engine.—Nov. 13.

Paper-Making.—L. W. Wright, of Sloane-terrace, Chelsea, engineer, for improvements in apparatus for making paper.—Nov. 15.

Spinning.—C. de Bergne, of Clapham, engineer, for improvements in machinery for spinning or twisting cotton, flax, silk, &c.—Nov. 15.

Engraving.—E. G. Giles, of Lincoln's-inn-fields, gent., for improvements on apparatus for engraving on copper.—Nov. 15.

Multiplying Drawings.—S. Garner, of Lombard-street, gent., for an improvement in the art of multiplying drawings and engravings, or impressions.—Nov. 12.

Bobbin-Net.—W. Crofts, of New Radford Nottingham, machine-maker, for improvements in machinery for making figured bobbin-net.—Nov. 20.

Cord-Cutting Machine.—W. Wells, of Salford, machine-maker, and G. Scholefield, Lancaster, mechanical draftsman, for an improved machine for cutting the pile or cord of fustians and other fabrics, of cotton, wool, &c.—Nov. 20.

Steam-Carriages.—R. Whiteside of Air, wine-merchant, for improvements in the wheels of steam-carriages, and in the machinery for propelling the same.—Nov. 20.

Steam-Engines.—A. Craig, of Edinburgh, for improvements in steam-engines.—Nov. 25.

Castors.—J. Lutton, of Tudor-place, Tottenham-court-road, chair-maker, for improvements on castors for furniture.—Nov. 25.

Carriage-Springs.—R. J. Barlow, of Rudley, Yorkshire, for improvements in springs applicable to carriages.—Nov. 25.

Ships' Channels.—J. Couch, of Stoke Devonport, Captain R. N. for improvements in ships' channels.—Nov. 25.

Sheathing for Ships.—J. T. Slade, of Carburton-street, Fitzroy-square, for an improved metallic sheathing for the bottoms of ships or vessels.—Nov. 25.

Paper-Making.—J. Donkin, of Blue Anchor-road, Bermondsey, civil engineer, for improvements in the machinery for making paper.—Nov. 25.

Warming Buildings.—F. A. Bernhardt, of Upper Montague-street, Montague-square, architect, for improvements in warming and airing buildings.—Dec. 4.

Steam Engines.—W. A. Noble, of Cross-street, Cherry Garden-street, Bermondsey, Surrey, engineer, for improvements in applying steam to the common and other engines.—Dec. 4.

Block Printing.—J. Hudson, of Gale, near Rochdale, Lancaster, calico-printer, for machinery applicable in block printing, on silk, woollen, cotton, and on paper.—Dec. 4.

Artificial Stone.—W. Ranger, of Great Deans-yard, Westminster, Middlesex, builder, for improved modes of forming blocks, casts, walls, &c., being improvements upon a patent granted to him for Ranger's artificial stone.—Dec. 4.

Forges.—J. West, of Crayford, Kent, blacksmith, for an improvement on forges.—Dec. 9.

Navigation.—E. Massey, sen., of King-street, Clerkenwell, Middlesex, watch-maker, for improvements in the apparatus for measuring the progress of vessels through the water, and for taking soundings at sea.—Dec. 9.

Physiognotype.—R. Rettfort, of the Tavistock hotel, Covent-garden, gent., for a newly invented machine, called a physiognotype, by means of which a perfect fac simile of the human countenance can be immediately produced, or the exact copy of a bust or of a living or other subject taken.—Dec. 18.

Improved Vehicle.—J. Hansom, of Hinchley, Leicester, architect, for an improved vehicle for the conveyance of loads.—Dec. 23.

Dressing.—J. Ferguson, of Carlisle, manufacturer, for a combination of processes for a new kind of dress or finish to certain goods.—Dec. 23.

Steam Engines.—E. Galloway, of Westmoreland-place, City-road, Middlesex, engineer, for improvements in steam engines.—Dec. 23.

Ships.—H. Stothert, of Bath, founder, for improvements in ships' hearths or cabouses.—Dec. 23.

Chisels.—J. Smith, of Bradford, York, machine-maker, for an improvement on chisels for cutting stone.—Dec. 23.

Brick Machinery.—R. Beart, of Godmanchester, Huntingdon, miller, for improvements in machinery for making bricks.—Dec. 23.

Bobbin-Net.—W. Crofts, of New Radford, Nottingham, machine-maker, for improvements in machinery for making figured bobbin-net.—Dec. 23.

Metal Pens.—R. Simister, of Manchester, ironmonger, for an improvement in the manufacture of metal pens.—Dec. 23.

Roving.—P. Fairbairn, of Leeds, York, mechanist, for an improved method of preparing, slivering, or roving hemp, flax, and other fibrous substances for spinning.—Dec. 23.

Levels.—J. Browne, of Bridgewater, Somerset, merchant, for an improved instrument for ascertaining levels.—Dec. 23.

SCIENTIFIC BOOKS PUBLISHED IN 1834.

Ackerley's Plan for Navigating the Thames. — Aikin's Calendar of Nature.—Ainsworth's Account of the Caves of Ballybunian.—Airy's Explanation of the Solar System.—Akerman's Catalogue of Roman Coins, 2 vols.—Alderson on the Nature of Steam, &c.—Allan's (Rt.) Manual of Mineralogy.—Allen's (W. E.) Treatise on Cucumbers, &c.—Art of Heraldry.—Asiatic Researches, vol. 18.—Babington's Flora Bathoniensis.—Bagster's Management of Bees.—Bechstein's Natural History, &c., of Cage Birds.—Beck's Treatise on Leprosy.—Belcher's Treatise on Nautical Surveying.—Bell's (And.) Mathematical and Physical Tracts.—Bertrand's Revolutions of the Globe described.—Betham's Gael and the Cymbri. — Billington's Architectural Dictionary. — Blackwall's Re-

searches in Zoology.—Bloxham's (H.) Monumental Antiquities of Great Britain.—Blundell's Principles, &c., of Obstetricy.—Blunt and Stephenson's Civil Engineer, Parts 1 and 2.—Boase's Treatise on Primary Goology.—Boivin's Treatise on Diseases of the Uterus.—Book of Birds.—Book of Animals (Class Mammalia).—Book of Fishes.—Book of Science, 2nd Series (Chemistry, &c.).—Booth's Art of Wine Making.—Bordwine's System of Permanent Fortification.—Brougham's Treatise on Cholera.—Brown's (Tho.) Anecdotes of the Animal Kingdom.—Brown's Book of Butterflies, &c., 3 vols.—Burns' Popular Guide to Health.—Calcott's Grammar of Music.—Carswell's Pathological Anatomy, Parts 4, 5, and 6.—Clarke's (T. H.) Architecture, &c., of Eastbury.—Combe's Principles of Physiology.—Cunningham's Essays on Electricity, &c.—Cutler's Surgeon's Guide in Dressing and Bandaging.—Cuvier's Animal Kingdom (Mollusca, &c.)—Cuvier's Animal Kingdom (Pisces).—Cuvier's Animal Kingdom, abridged by M'Murtrie.—Cyclopædia of Practical Medicine, vol. 3.—Dalrymple's Anatomy of the Human Eye.—Darvill's Treatise on the English Race Horse, vol. 2.—Delabeche's Researches in Theoretical Geology.—Don's Gardening and Botany, vol. 3.—Earnshaw's Theory of Statics.—Eccles' Treatment of Ulcers of the Leg.—Eden's Outlines of a New System of Philosophy.—Exley's Physical Objects.—Gilpin's Forest Scenery, by Sir T. D. Lauder, 2 vols.—Goodwin's Domestic Architecture, Part 2.—Grahame on Railways, Canals, and Roads, Part 1.—Granville's Illustrations of Abortion, &c.—Graves' Hortus Medicus.—Greener's Treatise on the Gun and small Fire-Arms.—Griffin's Observations on the Spinal Cord.—Guthrie's Anatomy and Diseases of the Neck, &c.—Hahnemann's Fragmenta de Viribus Medicamentorium.—Hall's (T. G.) Differential and Integral Calculus.—Hawkins' Memoirs of Ichthyosauri and Plesiosauri.—Hayward's Conversations on Horticulture, &c.—Higgins' Alphabet of Electricity.—Hogg's (T. J.) Culture of the Carnation, Pink, &c. (Supp. to.)—Hooker's Botany of British America, vol. 1.—Hoste's Naval Tacticks, transl. by Boswall.—Hunterian Catalogue of Comparative Anatomy, Part 1.—Inwood's Studies of the Architect from Nature.—Jardine's Naturalist's Library, vol. 4 to 6.—Jesse's Gleanings in Natural History, 2nd Series.—Jobson's Anatomy and Physiology of the Teeth—Lardner's Cabinet Cyclopædia, vol. 51 to 62.—Lee's (Isaac) Contributions to Geology.—Library of Useful Knowledge, viz., British Cattle; British Husbandry, vol. 1; Natural Philosophy, vol. 3; Bradley's Geometry.—Lindley and Hutton's Fossil Flora of Great Britain, vol. 2, Part 1.—Lindley's Ladies' Botany.—Lord's Popular Physiology.—Lowe's Elements of Practical Agriculture.—Macauley's Treatise on Field Fortification.—Macvickar's Inquiries on the Medium of Light.—Malte-Brun's System of Geography, 9 vols.—Malte-Brun's Principles of Geography.—Mammatt's Geological Facts of Ashby Coal Field.—Mantell's Floriculture.—Marsden's (W.) Treatise on Cholera.—Martelli's Officers' Guide for preparing Ships for Sea.—Mead's Compendium of Pharmacy.—Miller's (W. H.) Treatise on Differential Calculus.—Moseley's Mechanics applied to the Arts.—Mudie's Feathered Tribes of the British Islands, 2 vols.—Mudie's Natural History of Birds.—Murphy's Anatomy of the Seasons—Murray's (H.) Encyclopædia of Geography.—Murray's (J. and G.) View of Chemistry.—Natural History of Quadrupeds, Birds, and Insects.—Nicholson's Treatise on Dialling.—Nuttall's Ornithology of the United States, &c.—Nuttall's Systematic and Physiological Botany.—Pasley's Improvement, &c., of English Weights,

Measures, &c.—Paxton's Study of Human Anatomy, vol. 2.—Peacock's Hints on the Treatment of several Diseases.—Pearson's (H.) Syllabus of Algebra.—Percivall's Disorder and Lameness of the Horse.—Perkins' Elements of Drawing, &c.—Petherick's Essay on Primitive Preaching. —Pettigrew's History of Egyptian Mummies.—Pharmacopæia Homæopathica, edited by Dr. Quin.—Philip's (A. P. W.) Influence of Minute Doses of Mercury.—Philip's Inquiry into the Nature of Sleep and Death.—Phillips's (John) Guide to Geology.—Philosophical Transactions, 1833, Part 2.—Philosophical Transactions, 1834, Part 2.—Prior's Key to Keith on the Globes.—Pritchard's Natural History of Animalcules.—Proceedings of the British Association, 1834.—Prout's Chemistry, Meteorology, &c.—Ramadge's Consumption Curable.—Ram Raz on the Architecture in the Hindús.—Raspail's System of Organic Chemistry, transl. by Henderson.—Rattray's Botanical Chart.—Rennie's Alphabet of Natural Theology.—Rennie's Alphabet of Medical Botany.—Robson's Treatise on Marine Surveying.—Rogers' Fruit Cultivater.—Roget's Animal and Vegetable Physiology.—Samouelle's Entomological Cabinet, 2 vols.—Sea-Service; or Sketches of Ship-building, &c.—Simms on Mathematical Instruments.—Smith's (Geo.) Essay on the Construction of Cottages.—Somerville on the Connexion of the Physical Sciences. —Sopwith's Treatise on Isometrical Drawing.—Stephenson and Blunt's Civil Engineer, &c., Parts 1 and 2.—Stothard's Monumental Effigies of Great Britain.—Swan's Demonstration of the Nerves of the Human Body.—Taylor's (Janet) Lunar Tables.—Thomas's Anatomy of the Bones, &c.—Tiedemann's Comparative Physiology.—*Transactions:* Royal Asiatic Society, vol. 3, Part 3.—Cambridge Philosophical Society, vol. 5, Part 2.—Linnæan Society, vol. 17, Part 1.—Natural History Society of Northumberland, vol. 2, Part 1.—Irish Academy, vol. 17, Part 1.—Zoological Society of London, Part 2.—Zoological Society of London (Proceedings of), 1831-32.—Zoological Society of London (Proceedings of), 1833, Part 1.—Geological Society of Pennsylvania, Part 1. —Entomological Society, Part 1.—Provincial Medical and Surgical Association, vol. 2.—Venables' Aphorisms on Chemistry and Toxicology.—Waite on the Gums.—Walker's (Alex.) Physiognomy founded on Physiology.—Walker's (John) Principles of Opthalmic Surgery.—Wallace's Tables of Logarithms of Numbers.—Warrington's Chemical Tables.—Weatherhead's (P. H.) New Synopsis of Nosology.—Whewell's Treatise on Dynamics, Part 2.—White's (G.) Natural History of Selborne, by Brown.—Wight and Arnott's Descriptions of the Plants in India, vol. 1. —Wight's Contributions to the Botany of India.—Willcockes' Arithmetical and Mental Calculations.—Willett's Traits of Science and Invention.—Wilson and Duncan's Entomologia Edinensis.—Wright's Present State of Aural Surgery.—Young's (Miss) Studies of Trees.—*Bent's List.*

A Chemical Portable Laboratory, containing Dr. Black's blow pipe, spirit lamp, bulb tube, retort stand, funnel, evaporating dish, watch glasses, glass rods, set of test tubes, platinum hook, charcoal, litmus, turmeric and filtering paper, and above ninety select and useful tests, reagents, and appropriate apparatus for performing, with facility and safety, a course of instructive and entertaining experiments. By Robert Best Ede, Chemist to her Majesty.

OBITUARY OF PERSONS EMINENT IN SCIENCE AND ART, 1834.

Professor Karl Ludwig Harding, of the University of Göttingen, an eminent astronomer, whose name will go down to posterity with the important discovery of the planet Juno, which it was his good fortune to make in 1804. He has likewise rendered a very important service to astronomy by compiling accurate maps of those parts of the heavens in which planets may be expected to appear. After having been several years astronomical assistant to Schröter, he accepted, in 1805, a Professorship of Astronomy at Göttingen, which he retained till his death.

The Rev. Daniel Lysons, F.R.S.; A.S; H.S.; L.S. &c., a distinguished antiquary.

Mr. Richard Lander, the discoverer of the termination of the Niger, who, after all his painful toil, and mental and bodily sufferings in the cause of African exploration—after having escaped the treacherous and destructive influence of the climate—met his death on the eve of returning to enjoy the fruits of his noble labours, by the hands of heartless savages, while descending the river Nunn.

David Scot, M.D., Professor of Oriental Languages in St. Andrew's, Edinburgh.

Mr. George Cooke, the eminent engraver.

Thomas Stothard, Esq., Librarian to the Royal Academy, and one of the chief ornaments of our National School of Painting.

The Rev. Lewis D. De Schiveinitz, whose various scientific publications entitle him to an eminent place among the botanists of his time.

M. Jean Simon de Kerner, Professor of Natural History at Stuttgard.

John Fuller, Esq., a munificent patron of science, the favourite object of his liberality being the Royal Institution. He first gave 1,000*l.* to the funds. He then invested 3,333*l.* to found a Chair of Chemistry, with a salary of 1,000*l.* per annum; of which Chair Mr. Faraday is Professor. He next invested the like sum to establish a Chair of Comparative Anatomy and Physiology; to which Dr. Roget has been appointed. He also invested 3,000*l.*, which is to amount by interest, additions, or otherwise, to 10,000*l.*, and then to be available for the Institution: making his bequests a total of 10,000*l.* Mr. Fuller erected an observatory at his house at Rose Hill, Sussex.

Francis Douce, Esq. F.A.S., Member of the Society of Antiquaries at Caen; and of the Academy of Sciences at Caen: long distinguished for his great erudition in English antiquities.

Earl Spencer, F R.S. and S.A., whose delight it was to collect around him the most distinguished scientific men of his time—as Bankes, Davy, Wollaston, Young, Hatchett, &c. Earl Spencer was among the number who established the Royal Institution, of which he was chosen the first president.

Rudolph Ackermann, Esq., to whom we are indebted for the introduction of lithography, by his translation of the work of Senefelder, its inventer, and by specimens from his own presses.

Mr. Atkins, a young artist of great promise as a portrait-painter.

Sir John Barton, author of several ingenious inventions: as a floating compass; an atometer for measuring minute quantities; a draw-

bench, used in the Mint; the iris ornament; a hydrostatic floating lamp; a method for producing a perfect cube in the lathe; a hydrostatic balance, upon a large scale, used in the Mint and the Bank of England. Sir John had also for many years been engaged in perfecting a machine for producing specula for reflecting telescopes, with facility in the lathe.—Abridged from the *Literary Gazette*.

Mr. John Coney, engraver, ranked as "the Piranesi of England."

Rev. James Dallaway, a distinguished antiquary.

The Rev. Mr. Harriman, F.L.S., as a botanist and mineralogist esteemed for the extent and accuracy of his researches, particularly in the order of Lichens, many varieties of which were discovered by him.

James Heath, Esq., A.R.A., the celebrated engraver.

Captain Hoppner, who sailed with Sir W. Parry, and Captain Lyon, in their Polar Expeditions.

Lionel Lukin, Esq., inventer of a safety boat in 1785, a raft to raise persons from under ice, a bedstead for invalids, a pluviometer, &c.

Mr. H. Nixon, inventer of the Œolina or Æolian organ.

Robert Surtees, Esq., M.A.F.A.S., an erudite antiquary.

Edward Upham, Esq., F.S.A.

Captain James Weddell, F.R.S.E., who penetrated the southern regions towards the Pole, to a higher degree of latitude than any predecessor; and by his voyage added greatly, both practically and theoretically, to the nautical science of the country.—*Metropolitan.*

Dr. George Williams, Regius Professor of Botany, at Oxford.

Thomas Telford, Esq., F.R.S. and F.R.S.E., who ranks with Brindley, Watt, and Rennie, as a Civil Engineer unequalled in this, or, probably in any other country, for the number and importance of his public works. Of these it may be sufficient to mention the Ellesmere Canal commenced in 1790; the Caledonian Canal, 1804; the Glasgow and Carlisle Road, with 23 bridges; the Holyhead Road, from London to Dublin, with the Menai and Conway Bridges; and St. Katherine's Docks. The Menai Bridge will, unquestionably be the most imperishable monument of Mr. Telford's fame. Mr. Telford was President of the Institution of Civil Engineers: in the tribute of the Council to his memory it is truly said that "his various works are conspicuous ornaments to the country, and speak for themselves as the most durable monument of a well-earned fame: in number, magnitude, and usefulness, they are too intimately connected with the prosperity of the British people to be overlooked, or forgotten in future times; and the name of Telford must remain permanently associated with that remarkable progress of public improvement which has distinguished the age in which he lived." It is a singular and fortunate circumstance that Mr. Telford two or three days before his death, caused to be completed under his direction, the corrected M.S. of a detailed account of the principal undertakings which he had planned or lived to see executed.

Sir Gilbert Blane, Bart., M.D.

George Harvey, Esq., F.R.S., author of two papers—on Magnetic Intensity, and the Rates of Chronometers, in the *Philosophical Transactions* for 1824.

MEETINGS OF THE SCIENTIFIC AND LITERARY INSTITUTIONS OF LONDON FOR 1834—35.

Societies.	Times of Meeting	November.	December.	January.	February.	March.	April.	May.	June.
Royal Society -	Thur. 8½ P. M.	20, 27	11, 18	8, 15, 22, 29	5, 12, 19, 26	5, 12, 19, 26	2, 9, 30	7, 14, 21, 28	4, 18
Society of Antiq.	Thur. 8 P. M.	20, 27	4, 11, 18	8, 15, 22, 29	5, 12, 19, 26	5, 12, 19, 26	2, 9	7, 14, 21, 28	11, 18
Royal Institution	Fri. 8½ P. M.	..	..	23, 30	6, 13, 20, 27	6, 13, 20, 27	3, 10	1, 8, 15, 22, 29	5, 12
Royal Geog. Soc.	Mon. 9 P. M.	10, 24	8, 22	12, 26	9, 23	9, 23	13, 27	11, 25	8, 22
Geological Society	Wed. 8½ P. M.	5, 19	3, 17	7, 21	4, 25	11, 25	8, 29	13, 27	10
Linnæan Society	Tues. 8 P. M.	4, 18	2, 16	20	3, 17	3, 17	7, 21	5, 19	2, 16*
Horticul. Society	Tues. 1 P. M.	4	2	20	3, 17	3, 17	7, 21	5, 19	2, 16*
Zoological Soc.	Thur. 3 P. M.	6	4	1	5	5	2	7	4*
Zoological Soc.	Tues. 8½ P. M.	11, 25	9, 23	13, 27	10, 24	10, 24	14, 28	12, 26	9, 23*
Entomolog. Soc.	Mon. 8 P. M.	3	1	5	2	2	6	4	1, July 6*
Statistical Society	Mon. 8 P. M.	17	15	19	16	16	20	18	15
Astronomical Soc.	Fri. 8 P. M.	14	12	9	13	13	10	8	12
Phrenolog. Soc.	Mon. 8 P. M.	3, 17	1, 15	5, 19	2, 16	2, 16	6, 20	4, 18	1, 15
Society of Arts	Wed. 7½ P. M.	5, 12, 19, 26	3, 10, 17	7, 14, 21, 28	4, 11, 18, 25	4, 11, 18, 25	1, 8, 15, 22, 29	6, 13, 20, 27	3, 10
Society of Arts	Tues. 8 P. M.	11	9	13	10	10	14	12	9
Royal Soc. of Lit.	Wed. 3 P. M.	5, 19	3, 17	7, 21	4, 18	4, 18	1, 15	6, 20	3, 17
Royal Asiatic Soc.	Sat. 2 P. M.	..	6	3, 17	7, 21	7, 21	4	16	6, 20, July 4, 18
Royal Col. of Phy.	Mon. 9 P. M.	..	..	26	23	30	27	25	29
Royal Med. and Chirurg. Soc.	Tues. 8½ P. M	11, 25	9, 30	13, 27	10, 24	10, 31	14, 28	12, 26	..
Med.-Bota. Soc.	Tues. 8 P. M.	11, 25	9, 23	13, 27	10, 24	10, 24	14, 28	12, 26	9, 23
Medical Society	Mon. 8 P. M.	3, 10, 17, 24	1, 8, 15, 22	5, 12, 19, 26	2, 9, 16, 23	2, 9, 16, 23	6, 13, 27	4, 11, 18, 25	..
Harveian Society	Mon. 8 P. M.	3, 17	1, 15	5, 19	2, 16	2, 16	6	4, 18	1, 15
West. Med. Soc.	Sat. 8 P. M.	1, 8, 15, 22, 29	6, 13, 20	3, 10, 17, 24, 31	7, 14, 21, 28	7, 14, 21, 28	4, 11, 25	2, 9, 16, 23	..
Institution of Civil Enginr.	Tues. 8 P. M.	..	..	6, 13, 20, 27	3, 10, 17, 24	3, 10, 17, 24	7, 14, 21, 28	5, 12, 19, 26	2

ANNIVERSARIES.—Royal, Dec. 1, 11 A.M.—Antiquaries, April 23, 2 P.M.—Royal Institution, May 1.—Royal Geographical, May 13, 1 P.M.—Geological, Feb. 20, 1 P.M.—Linnæan, May 24, P.M.—Horticultural, May 1, 1 P.M.—Zoological, April 29th, 1 P.M.—Astronomical, Feb. 13, 3 P.M.—Phrenological, March 31, 8 P.M.—Royal Society of Literature, April 30, 3 P.M.—Asiatic, May 9, 1 P.M.—College of Physicians (Harveian Oration), June 25th, 4 P.M.—Royal Medical and Chirurgical Society,

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THE

BRITISH YOUTH'S READER.

ACCOUNT OF THE ANCIENT BRITONS, AND THE INVASION OF THE ROMANS.

LESSON I.

1. THE coast of Britain, opposite Gaul, was inhabited by foreign traders, who, finding the situation convenient for their commerce, at length settled there; and, cultivating the country round them, in time became masters of the parts where they, at first, had only been suffered to reside.* 2. The natives dwelt inland, and held no communication with the intruders; they lived in rude-built cottages, and fed upon flesh procured by hunting, or the milk of their herds. What little clothing they wore was made of the skins of beasts; but their arms, legs, and thighs, were naked, and usually painted blue. 3. Their beards were close shaved, or cut, except on their upper lips; but their hair was suffered to grow long, and fall upon their shoulders. 4. They were pagans, or worshippers of idols, and their priests, who were called Druids, dwelt in caves, woods, or hollow trees, feeding on acorns and wild berries; but by their simplicity, and severity of their manners, commanded universal respect and obedience. 5. To counterbalance this simplicity of living, they inculcated the most gross superstition, and sacrificed human victims, whom they burned even in multitudes in the bodies of their idols, which were composed of wicker-work. 6. Their money was of brass, or iron rings, of various weight, with which they trafficked with each other for different commodities. The country was

* In a class, the reader will pause here, and the next boy take up 2. The sentences are short, as this will tend to keep the class attentive.

third year of his age; some historians say by poison, others by drinking. *Robinson's Ancient History.*

al-ex-an-der	ser-vi-cea-ble	ex-tra-or-din-a-ry
com-pe-ti-tors	ad-mi-ra-ble	bu-ce-pha-li-a
dis-con-so-late	un-for-tu-nate	
cel-e-bra-ted	ig-no-mi-ny	
bu-ce-pha-lus	mo-de-ra-tion	
phil-o-so-pher	his-to-ri-ans	

NATURAL HISTORY OF THE CAMEL.

LESSON V.

1. The camel is a native of Arabia, and is chiefly confined to that and the adjacent countries, where it has, from time immemorial, been used in traversing those immense deserts of burning sand, which are impassable to every other quadruped except the dromedary, which, although distinguished by a different name, and by having two hunches on its back, while the camel has only one, is supposed to be originally of the same race.*

2. The camel is, to the Arabian, what the rein-deer is to the Laplander. Its milk is rich and nutritive; its flesh, when young, is excellent food, wholesome and invigorating; and its hair, or fleece, which falls off always in the spring, is manufactured into fine stuffs, and almost

* There are one humped and two humped dromedaries, and one humped and two humped camels.

mountainous places. It is about the size of a domestic goat, and resembles one in many respects. It is most agreeably lively, and active beyond expression. The chamois' hair is short, like that of the doe; in spring it is of an ash colour, in autumn a dun colour, inclining to

black, and in winter of a blackish brown. This animal is found in great plenty in the mountains of Dauphiny, of Piedmont, Savoy, Switzerland, and Germany. They are peaceful, gentle creatures, and live in society with each other. They are found in flocks of from four to fourscore, and even a hundred, dispersed upon the crags of the mountains. 2. The large males are seen feeding detached from the rest, except in rutting time, when they approach the females, and drive away the young. The time of their coupling is from the beginning of November to the end of October; and they bring forth in April and March. The young keep with the dam for about five months, and sometimes longer, if the hunters and the wolves do not separate them. It is asserted that they live between twenty and thirty years. Their flesh is good

for-mi-da-ble
prop-a-ga-ted
ac-com-pa-nies

WILLIAM THE CONQUEROR.

LESSON XII.

1. William, Duke of Normandy, was in his person tall and muscular, and so strong, that few men could bend his bow. After his victory, he resolved to subdue the castle of Dover and the whole of Kent; but Stigand, the Archbishop of Canterbury, and Egilsin, the abbot of St. Augustine's, resolved, if possible, to render the yoke which they could not avoid, as light as possible; and, therefore, assembling the people of Kent in the city of Canterbury, they declared to them the danger that threatened them, the misery of their neighbours, and the pride and insolence of the Normans, who would reduce them to bondage; exhorting them rather to die like men for the laws of their country, than to submit to such disgraceful servitude. 2. The people, by common consent, accepted the proposal, and the archbishop, Stigand, with the abbot, Egilsin, were declared leaders of the party. All being prepared, on a day appointed, they met at Swanscomb, two miles west of Gravesend, where, hiding themselves in a wood, they waited the approach of Duke William. On the second day, finding their enemy draw

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EXPRESSION.

It remains to be considered that we comprehend and feel the subject, without which, all delivery is tame and languid, unaffecting and wearisome. What we read or speak *unfelt*, is like a painting without light or shade, in which symmetry of parts and good colouring occur, but which, unless raised or brought forward on the canvass, die away upon the view. Spirit and feeling are as necessary to idea as to sight.

It is a maxim of Quintilian, that it is not of so much moment what our compositions are, as how they are pronounced, since it is the *manner* of delivery by which the audience is moved. An instance is on record of this facility working a surprising effect, in an oration of Cicero's, which, to read, inspires scarce the least interest,—all must have depended on the *manner* in which it was delivered.

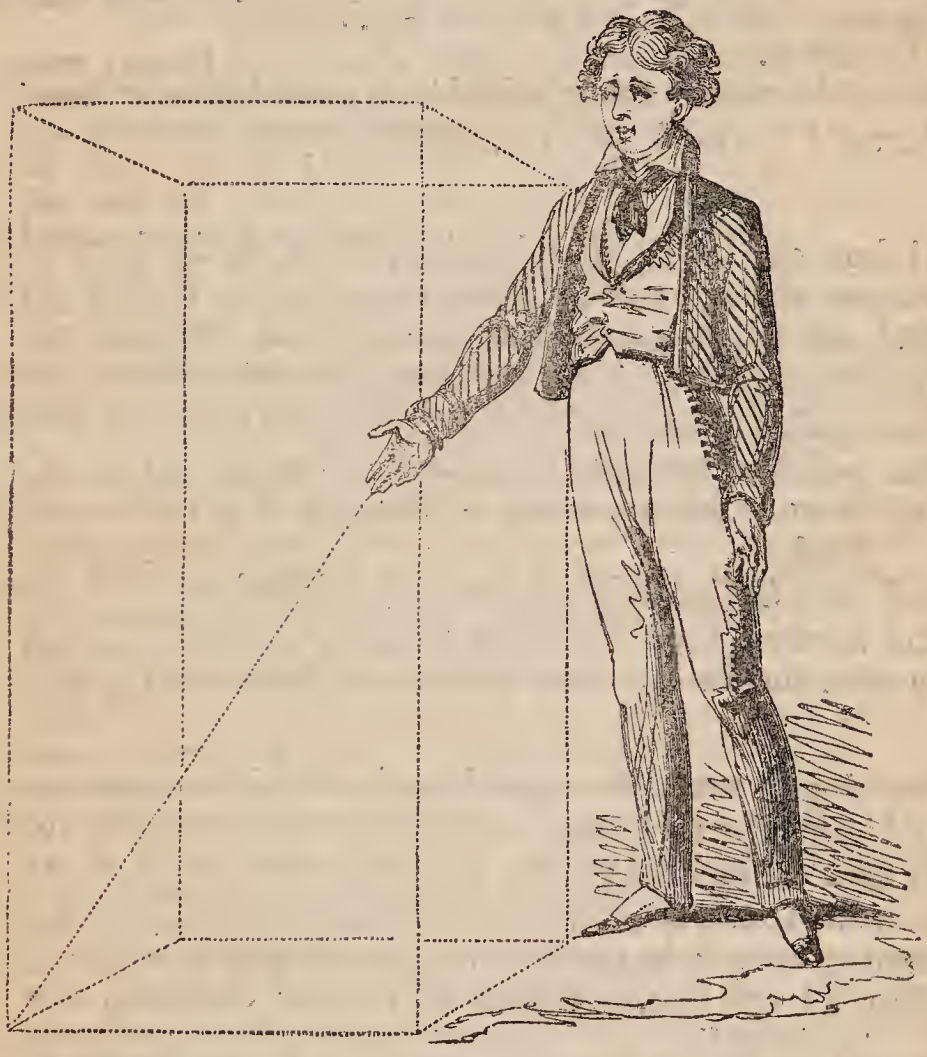
After Cæsar's triumph, several of the adherents of Pompey were proscribed by the victor. Cicero undertook to plead for one of these, by name Ligarius, who was most obnoxious to Cæsar, and who answered—"We may venture to hear Cicero display his eloquence; for I know the person he ventures to plead for, to be both a bad man and my enemy." Nevertheless, the orator proceeded, and he so worked on Cæsar's feelings, by painting the field of Pharsalia, by which he had gained the empire of the world, that Cæsar shivered in terror and amazement, and let the papers drop from his hand. This was the more remarkable, for Cæsar was himself one of the first orators of the time, and knew all the arts of address; but the conqueror was conquered, and Ligarius pardoned.

Does the pupil look for *rules* to acquire this? He will look in vain here. Let him go to public meetings in times of political excitement; let him attend the sanctuary where some faithful servant of God, under deep conviction himself, enforces on a cold and unbelieving world the awful truths of redemption and grace; let him snatch a spark of the fire kindled at the torch of earnest truth, and we venture to say that his compositions and extemporaneous sentiments will not fail in their effect. BE IN EARNEST, says one Elocutionist, whose work is before us; MAKE THE SENTIMENTS AND WORDS YOUR OWN, AND SPEAK UNDER THAT IMPRESSION, says another—good injunctions, and we commend them to the attention of the pupil. It is under a conviction that too much time is taken up in acquiring dry rules, to the neglect of the *spirit* of delivery, which induced us to bestow the labour and patient attention we have, in the marginal indications of this work. We request teachers to see these attended to and exemplified by the pupils under their care; and, if the preceptor feels his own deficiency, let a competent person be called in at least once a week, to read and recite such passages as may be thought judicious: it induces a spirit of emulation which does great things in this respect. In recitation, it is often considered enough that the words be conned by rote. From experience, I would say, let the pupil make himself thoroughly master of all the shades of expression in the passage before it is laid aside for another. If he delivers it with any degree of propriety and spirit, all his subsequent efforts will be brought to a test with the excellence of

his *pet* piece, for delivering which he may have received the approbation of his instructor, or experienced the admiration of his schoolfellows.

ACTION.*

The difficulty of describing action by words will be allowed by every one; and if we were never to give any instructions but such as should completely answer our wishes, this difficulty would be a good reason for not attempting to give any description of it. But there are many degrees between conveying a precise idea of a thing, and no idea at all. Besides, in this part of delivery, instruction may be conveyed by the eye. This vehicle is addressed on this occasion; and sketches representing the attitudes described, are annexed, which it is hoped will facilitate the pupil's conception.



The accompanying sketch represents the attitude in which a boy should always place himself when he begins to speak. He should rest the whole weight of his body on the right leg; the other just touching the ground, at the distance at which it would naturally fall, if lifted up. te show that the body does not bear upon it. The knees should be

* Walker's Elements.

BATTLE HYMN OF THE LEAGUE.

Gratitude. Now glory to the Lord of hosts, from whom all glories are;
And glory to our sovereign liege, king Henry of Navarre:
Joy Now let there be the merry sound, of music and of dance,
Through thy corn-fields green, and sunny vines, O pleasant land of France!
Affection. And thou, Rochelle, our own Rochelle, proud city of the waters,
Again let rapture light the eyes of all thy mourning daughters:
As thou wert constant in our ills, be joyous in our joy,
For cold and stiff, and still are they, who wrought thy walls annoy.
Martial joy. Hurrah! hurrah! a single field hath turned the chance of war:
Hurrah! hurrah! for Ivry, and Henry of Navarre.

Anxiety. O! how our hearts were beating, when, at the dawn of day,
We saw the army of the League drawn out in long array;
Indignation. With all its priest-led citizens, and all its rebel peers,
And Appenzel's stout infantry, and Egmont's Flemish spears.
There rode the brood of false Lorraine, the curses of our land;
And dark Mayenne was in the midst, a truncheon in his hand:
And as we looked on them, we thought of Seine's impurpled flood,
And good Coligni's hoary hair, all dabbled with his blood!
Invoking. And we cried unto the living God, who rules the fate of war,
To fight for his own holy name, and Henry of Navarre.

Admiration. The king is come to marshal us, in all his armour drest,
And he has bound a snow-white plume upon his gallant crest.
Tenderness. He looked upon his people, and a tear was in his eye;
Sternly. He looked upon the traitors, and his glance was stern and high.
Joy. Right graciously he smiled on us, as rolled from wing to wing;
Down all our line, a deafening shout, "God save our lord, the king."
Proclaiming. "And if my standard-bearer fall, as fall full well he may,
For never saw I promise yet of such a bloody fray,
Press where ye see my white plume shine, amidst the ranks of war,
And be your Oriflamme to-day the helmet of Navarre."

CHRIST TO HIS CHURCH.

AWAKE, awake; put on thy strength, O Zion; put on thy beautiful garments, O Jerusalem, the holy city: for henceforth there shall no more come into thee the uncircumcised and the unclean. *Rousing. Promising.*

Shake thyself from the dust: arise, and sit down, O Jerusalem: loose thyself from the bands of thy neck, O captive daughter of Zion. *Comforting and Compassionating.*

For thus saith the Lord, ye have sold yourselves for nought; and ye shall be redeemed without money. For thus saith the Lord God, My people went down aforetime into Egypt to sojourn there; and the Assyrian oppressed them without cause.

Now, therefore, what have I here, saith the Lord, that my people is taken away for nought? They that rule over them make them to howl, saith the Lord; and my name continually every day is blasphemed. *Indignation.*

Therefore my people shall know my name: therefore they shall know in that day that I am he that doth speak; behold, it is I. *Threatening.*

How beautiful upon the mountains are the feet of him that bringeth good tidings, that publisheth peace; that bringeth good tidings of good, that publisheth salvation; that saith unto Zion, thy God reigneth! Thy watchmen shall lift up the voice; with the voice together shall they sing: for they shall see eye to eye, when the Lord shall bring again Zion. *Comforting. Gratitude. Promising*

Break forth into joy, sing together, ye waste places of Jerusalem: for the Lord hath comforted his people, he hath redeemed Jerusalem. *Rejoicing*

The Lord hath made bare his holy arm in the eyes of all the nations; and all the ends of the earth shall see the salvation of our God. *Solemn promise.*

LII. CHAP. ISAIAH.

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